AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 7, No. 19. WEEKLY. | NEW YORK, MAY 10, 1884. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

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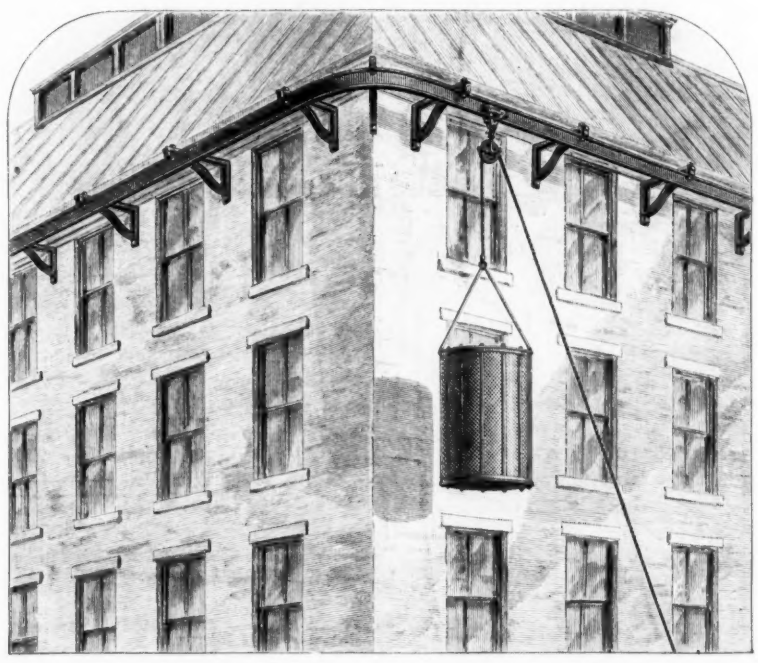
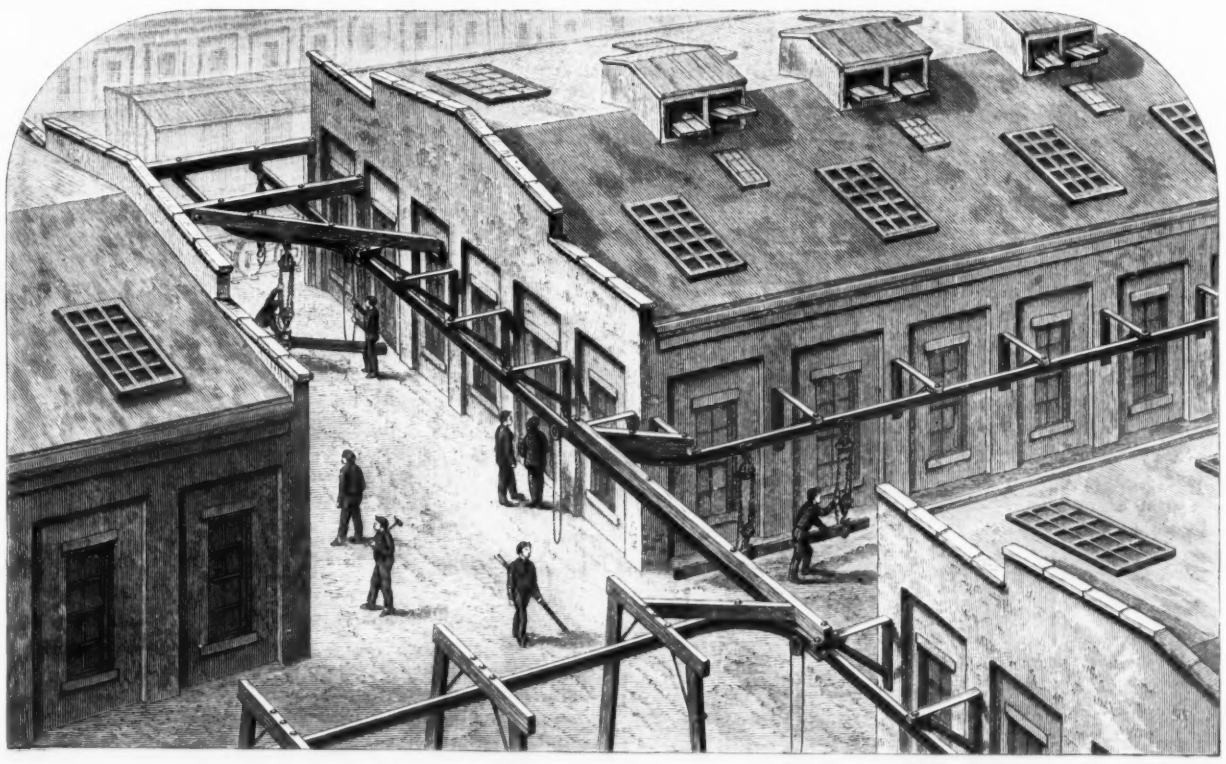
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

An Overhead Tramrail System.

Although so much attention has been given in this country to labor-saving machinery of all sorts, very little attention has in general been paid to the great lack of economy in handling material, whether raw, finished, or in process. The importance of this matter has of late attracted great attention from manufacturers, and a number of excellent devices tending to greater economy in this direction have been introduced. For many purposes an overhead tramrail is best adapted to the transporting of loads. It is entirely out of the way; it can be made to reach any desired portion of a building or yard; and a hoist is easily operated in connection with it, so that a load may be picked up and moved without any intermediate transfer. We illustrate herewith some applications of a system of tramrails which has been developed and patented by the Yale & Towne Manufacturing Company, of Stamford, Connecticut. This tramrail consists of I-beams which are supported in a novel way by bolts which pass through the upper flange and into the web of the beam. Running on the bottom flange of the beam are 4-wheeled trolleys, also of a novel construction, in which the axes of the wheels are parallel with the upper side of the bottom flanges of the track, so that the trolleys run with very little friction. The novel mode of hanging the track also allows the size of the wheels to be as great as the depth of the I-beam will permit, thus still further reducing the friction. Our illustrations show two among many applications of this system. The first is a picture of a part of a system furnished by the Yale & Towne Manufacturing Company for the Brush Electric Company, of Cleveland. The system includes in all about 1,500 feet of track, and is used for transporting loads about the yards, in moving loads in and out of the shops, in handling ashes from the boilers, and indeed in all sorts of transportation. The track is provided at all necessary points with switches or turn-tables for changing the direction of motion. It is supported either by trestle or by brackets against the building, or on the inside by simply bolting to girders already in place.



OVERHEAD TRAMRAIL SYSTEM APPLIED TO THE GOVERNMENT PRINTING OFFICE.



OVERHEAD TRAMRAIL SYSTEM IN THE WORKS OF THE BRUSH ELECTRIC CO.

The other illustration is a picture of the application of the track to the Government Printing office at Washington, where it was placed for use as a fire escape. The cage suspended from the trolley may be moved opposite any window, when the occupants may step into the cage and be lowered to the ground. These tracks have been placed in a great variety of situations by the company, and have been made of all capacities, up to five tons. The log-yard of the Singer Manufacturing Company, at Cairo, Ill., is provided with about half a mile of this track of the capacity of five tons, which is extensively and most economically used in their business.

Steamer Aurania.

The fine new steamer Aurania, belonging to the Cunard Line, which our readers will remember had her engines badly damaged on her first voyage last year through the breaking of the main rod of the high-pressure engine, is in service again, and has made a good run from Liverpool, the time having been a little over seven days. In order to repair the damaged part of the engine, the whole of that part of the machinery was taken out of the ship and the engines rebuilt in the shops. A new high-pressure cylinder was put in, and renewals were made wherever damage had been done by the fractured rod. New steel rods were made for all the crank connections, special care having been taken that the blooms from which they were forged should be of the best quality. Mr. Brown, whose able management of the disabled engines we noted last year, continues to be chief engineer of the Aurania.

Of all common metals Zinc expands and contracts the most for a given increase or decrerse of temperature; hence it is sometimes valuable where expansion and contraction with variations of temperature are desirable.

Boiler Repairing.

BY GEORGE MARSHALL.

Boiler repairing requires experience and skill; in addition to these it requires good judgment. Without the latter the repairs will frequently be an injury instead of a benefit. If too much rigidity is caused to the boiler by reason of the patch, unequal expansion and consequent injury are the result, and it is here, principally, the most difficult part of the business arises. In many cases the boiler maker sent out on a repair job is incompetent to arrive at a correct conclusion in respect to the real requirements of the case, yet he proceeds to business without any hesitation, cuts out the defective piece or pieces, and personally goes to the shop, ostensibly to attend to getting out the patches; in reality to consult with the foreman as to the correctness of his proceedings. It frequently occurs that his methods are not approved by the higher power, and on his return it is noticed that the patches are considerably enlarged, or the form changed, so that the best results may follow. In every boiler shop there are certain men employed for no other purpose than that of repairs, they having had the experience necessary to insure satisfactory work in every case, their frequent consultations with the foreman in the earlier days of their intimacy leading the latter to repose implicit confidence not only in their skill but in their judgment. Some men (not especially drilled) will find in the center of a medium or large sized patch a defect which should be remedied by the removal of the entire piece. There an error of judgment is frequently committed, and the boiler maker proceeds to put a patch on a patch, the effect of which, according to location, will be an excessive expansion and corresponding distortion of a weaker part. On explaining the state of affairs to the foreman, on his return to the shop, a piece is got out large enough to take the place of the large piece, and the latter is immediately taken out and the new piece put in.

Sometimes a boiler maker of intelligence and experience will be instructed in regard to his business, either by the engineer or proprietor, and if their advice was followed serious injury would result, yet boiler makers sometimes will be led contrary to their own judgment, only, however, in cases where the novice knows more than the expert.

Some years ago I read in an English journal an account of an explosion of a boiler, and the loss (if I remember rightly) of six lives. On judicial inquiry the owner of the boiler was placed on the witness

stand, and when questioned in regard to the safety of the boiler positively swore that it was in good condition. The Crown officer cross examined the witness in regard to repairs, and it was finally admitted by the witness as a reason for his emphatic statement in regard to condition at the time of the accident "that the boiler had been repaired by himself and a neighboring farmer, who was very handy in that line of business." Whether the explosion was caused by the repairs or not, I have never been able to determine.

There are many "neighboring farmers" very handy in that line of business, even in this country, but personally I prefer giving their boiler repairs a very wide berth. I have frequently been called upon to get out patches for men of this stamp, and have been amused by listening to their experience.

Patching is really a nice part of boiler making, although it is disagreeably dirty. An experienced workman will make his mental calculations almost as soon as he sees his work, and proceed to business without delay. The bearings are all taken in an instant, the extent of damage is computed as quickly, and seldom is an experienced man mistaken in his calculations. "Hard patching," in my opinion is much simpler than "soft patching." The first named is put on with rivets; the latter with bolts. There are some bolt patches put on which properly should not be called "soft," as the bolts are put in as numerously as rivers would be, and the patch caulked. These are put on where it is impossible to hold the rivet with sledge or bar, while the soft patch is frequently put on in places where access is possible for such purpose. The greatest amount of soft patching is done on vessels. By vessels I mean anything from a tug to the largest steamship—not to their hulls but to their boilers. Where soft patches are required the usual custom (if in a crooked place) is to make a pattern with light sheet lead, first cutting such holes as may be required, and removing such rivets as may be necessary to insure tight work with bolts, the lead receiving the impression of holes and irregularities of surface.

Soft patches are usually made of iron or steel, from $\frac{1}{8}''$ to $\frac{3}{16}''$ thick. After the patch has been formed according to the lead pattern, the holes are punched (allowance being made for inequality of thickness between pattern and patch) trimmed and lipped; the latter process being simply turning a small bevel flanged all around the patch, as evenly as possible, to aid in holding the cement by which the patch is made tight. If a skillful workman is not employed at this business, it frequently happens that the patch is heavier than the sheet, and in such case an imperfect job is the result. It is necessary to get into solid iron for the outer edges of the patch to be bolted to; the inner part, no matter how much worn, can be pulled to the patch by inside washers. The cement used is generally made of red and white lead, mixed with fine cast-iron filings or borings. Sometimes a cement is made of sugar of lead, litharge, and other chemicals. This is also an excellent cement for the purpose. I do not know of much difference between this and the lead, except in cost.

The cement being made, and the patch all ready, bolts are put in "where they will do the most good," and where regular machine bolts are used the head is protected with a grummet, or packing of lamp-wick slushed with white lead. A washer is put on the outside, the nuts carefully, but only partially, screwed up, until all the bolts are in, when they are screwed up with care and precision until the patch is tight and secure. This is easily written, but the patch is not put on so easily. Many times days will be consumed in putting on a patch which ordinarily should not take hours. The reason of this is the difficulty of getting in the bolts. These, when it is necessary, are "strung;" that is, a string is fastened around the thread in such a manner that the string will not interfere with the passage of the bolt through the hole, a flexible wire is put in through the hole, and wanders around among tubes and flues until seen and captured by the assistant inside, the location of the patch being invisible to the assistant's eye by reason of flues and tubes, perhaps the furnace intervening. After the string is fastened to the wire, the outside man, being notified, gradually draws on his wire. Sometimes the bolt will get entangled among braces or between flues and be lost; at others, just as it becomes visible to the eye of the outside worker, the string being worn by friction allows the bolt to drop and the scene has to be re-enacted.

There are patch bolts made for soft patching, the heads of which, being round and only the diameter of the hole, will permit of their being put in from the outside. The head of the bolt is conical, and a sheet-iron collar is forced in by the screwing up of the nut. This permits of the bolt being screwed up to its full capacity, but requires accuracy in the diameter of the hole. They are expensive and patented, and they have not come into general use.

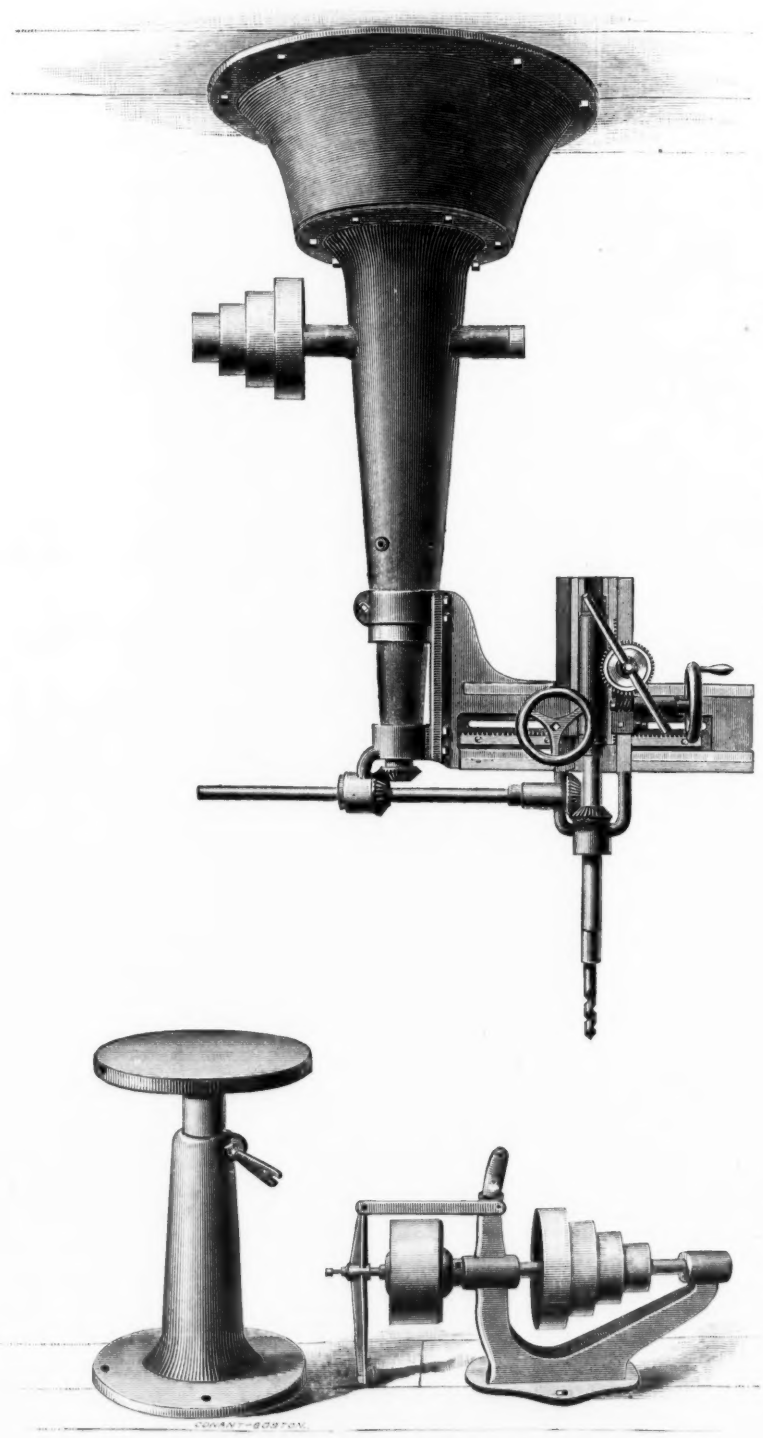
I have heard of many patches being put on by other than boiler makers, but I think, in the majority of cases, they were old patches renewed; new cement and bolts being put into an old patch.

I have never seen over six patches that were put on by engineers, and I grieve to say they were very poorly done, and required expert attention in a very short time. One of these (a patch in a furnace) was caulked with *hemp*.

I would recommend the "jack-of-all-trades" and "neighboring farmers" to give boiler repairing a wide berth, as the interests involved are too important to be trifled with, and the consequences too serious should accident follow their unskillful work.

The Concord Suspended Radial Drill.

The engraving presented with this represents a machine manufactured by Hobbs, Gordon & Co., Concord, N. H. The advantages claimed for this drill are, that being suspended from overhead it leaves the floor space unincumbered, enabling large pieces to be handled and drilled. The arm swinging entirely around the column, such pieces as cylinders or other pieces having holes in a circle may be located centrally under the column, when all the holes may be reached without moving either the piece or the sliding head. This, of course, gives twice the diametrical capacity with the same overreach of arm.



THE CONCORD SUSPENDED RADIAL DRILL.

The distance from base to lower end of spindle, when raised to its highest point, is six feet. The greatest distance from center of column to center of spindle is twenty-nine inches, making the diametrical capacity of drill 58 inches.

In the machine shown the spindle has a vertical movement of ten inches, and is operated by hand-wheel, worm and gear. It has quick return by lever and rack, and is counterbalanced by a spring. The radial arm can, when desired, be clamped to the column by the screw.

The adjustable table shown is furnished with each machine. This table is 20″ diameter, and has a vertical movement of 12″, by means of a central screw. The extreme height of table from floor is 3 feet. Countershaft is driven by self-lubricating pulley.

Early Railroad Operating.

Fifty years ago this month, the first division of what is now the Pennsylvania Railroad was opened between Philadelphia and Columbia, a distance of 81 miles. The railroad was built by the State of Pennsylvania, and it was opened as a public highway, where any person could run a car on paying the fixed toll charges. The motive power was horses, or, more truly speaking, mules, and the method of moving trains was decidedly primitive. The track was single, and "trains," which generally consisted of a single car resembling an omnibus, passed each other on turn-outs. Half way between the turn-outs was a post, and the train which passed this post had the right to the road to the next turn-out. When two trains were approaching each other, it was an important matter to pass the post first, and the zeal to obtain the resulting advantage often led the "engineers" to urge on their mules so vigorously near the vantage point that trains frequently tried to pass each other on the same track. When this happened bloodshed would often result, for the engineers would get down and pound each other, and not infrequently the passengers would take part in the melee. Numerous attempts were made to introduce better rules of the road, but our pioneer railroad men do not appear to have been amenable to discipline, so about the time the locomotive displaced the mule the State had to take the work of operating into its own hands. The Pennsylvania Railroad Company still cherish in comfortable idleness in the Jersey City meadow shops, the locomotive said to have been the first to run upon their road, but they have no sign or token of the patient mule which stood the heat of the conflict before the "John Bull" was evolved from the iron furnace.

Encouraging Enterprise Abroad.

The *Mechanical World* advises the manufacturers of machinery in Britain, who are suffering from depression of trade, to turn their attention to the needs of India for improved industrial appliances. They say "the necessity for railway extension is now being generally accepted, and we may shortly hope that the manufacturers of railway structures and machinery will be busy on this work. The development of the wheat trade follows immediately a district is opened up, and if our agricultural machinists would introduce simple and cheap labor contrivances, they would shortly be busy. Expensive steam plows, complicated reaping machinery, and five-furrow plows are beyond the pockets and intelligence of the majority of the natives of India. They may be educated later to be able to appreciate these good things, but what is required at the present moment is slight improvements on their ordinary agricultural tools—cheap plows to sell at 15s. to a pound a piece. Small pumps, galvanized tanks, and such things, of inexpensive outlay, are what are required in newly-opened districts. Where the trade has become more developed, the introduction of milling machinery, whereby the wheat can be ground into flour before shipment, is very much to be desired."

Similar advice might be taken with advantage by our merchants in regard to the undeveloped industries of Mexico and the South American States.

As an instance of the value of a good interchangeable system of doing work we note what was done at the elevated railroad shops last week. A locomotive came in with a broken crankpin, and it was decided as advisable to put in new axles and axle-boxes. The old ones were taken out and new ones put in, with all connections fitted in the best shape, and the engine was out within six days. There was no special effort to hurry up the job, but it came out in the ordinary run of shop operations, the prompt way it was done being due to all fittings being ready and of the exact size they are represented to be.

Oddity and Science in the Construction of Cupolas.

BY THOMAS D. WEST.

Economy in the use of fuel, and fast melting, are points sought for in constructing cupolas. To this end many odd features have been introduced. The noticeable oddity of some cupolas is in their outline, while with others it is all in the tuyeres. Then again we see the two combined. I have often thought that oddity was devised to bewilder and blind, more than to attain improvements in practical results. At least the attainment of oddity is sometimes the only success. By oddity in cupola construction is meant a departure or break from the plain round cupola, having one row of either round or flat tuyeres. The different oddities if shown might fill a fair-sized book. Out of them all but very few have any advantage over the common tuyere straight cupola. Europe no doubt is far ahead of our country in the origination of new designs for cupolas, but whether she has accomplished anything more than America in true economy and speed is a point I would be greatly pleased to have some one, acquainted with practice there, write about. Should any be so kind as to compare notes with us I would be pleased to have them confine their tests to the two following points: First, the fluidity of the iron. Second, the amount of iron the cupola can cleanly and successfully melt in a given time. These two points are generally ignored in all newspaper accounts of cupola working. What is one to know of any benefit accruing by the footings showing 1 to 8 or 10, if he is not informed of the fluidity of the iron melted? Any cupola can be made to melt one to 8 or 10, but whether the metal is good for pouring or running solid blocks, or thin stove plate castings, is the point we should know of to judge as to the merits of the economy in fuel.

Regarding the length of time a cupola may be run without bunging up is another point of importance. If one can daily melt ten tons in a 30″ cupola, where others can hardly do it in a 40″ cupola, there surely is some advantage gained.

The running of cupolas is somewhat like foot racing. Some can do excellent work in a short run, but give them a long one, and they soon become "played out."

With reference to where there is a failure in the length of time a cupola will melt satisfactorily, I will venture the assertion that the fault is more often due to mismanagement, than to the design of the cupola. In the common cupola, so popular with us, there is much intelligent melting being done. Cupola reports recently collected by me from many States, show this fact very clearly.

The great fault with our common cupola is that of having so much heat escape up and out of the stack. Could the heat from two cupolas thus lost be concentrated into a third cupola, a person would not be far off in saying iron could be melted. Some, to derive benefit from this escaping flame, make their charging door as high as they practically can. Others try to construct the cupola so as not to generate this flame. To this end the Colliau cupola, with which many are familiar, was designed. The principle involved is simply the admitting of an upper volume of air or oxygen to unite with the gas liberated from the fuel by the bottom tuyeres. The flame one sees in common cupolas is caused by the escaping gas meeting with the oxygen of the air. If, instead of allowing this gas to reach the charging door to receive oxygen, we admit oxygen about at the height above the first row of tuyeres where the melting point commences, we there generate the flame, or burn the gases, that otherwise pass up the stack. If we can confine the heat thus produced to the melting point, instead of letting it pass up the stack, there of course must be some benefit derived. In the Colliau cupola little or no flame is seen until the iron is about all melted. This fact is pointed to as evidence of its economy in the use of fuel.

The amount of air admitted through the upper tuyeres, to combine with the gas produced by the air passed through the lower tuyeres should only be sufficient to consume the gas generated. If more than this is admitted, the solid carbon, or commonly speaking, the fuel, will be attached and converted into gas which will escape, thereby causing imperfect combustion. If by two rows of tuyeres more gas is made than there is oxygen furnished to consume, the fact can readily be known by the amount of flame seen at charging door and in the stack. With reference to what size upper and lower tuyeres, should be in order to tend towards a thorough combustion, a table which I am preparing will, when completed, give what I think the the proper proportions for cupolas of all classes.

As there are oddities in cupola designs that show no gain over the common cupola, it may interest the reader to learn of some that are doing good work. The cupolas shown are melting economically, and with speed. Two of them embody the principle of admitting oxygen through the upper tuyeres for the purpose described. The oddity in Messrs. Callaham and Dearmon's cupola is all confined to the tuyeres. The blast enters an inner wind belt *F*, which extends entirely around the cupola. From this belt the blast enters the cupola through seventeen tuyeres, a section of which is seen in Fig. 2. At *K*, the front view is seen, and at *B*, a section through the center. The manner of setting the tuyeres will be better understood by noticing *F*, in the elevation of the cupola, Fig. 3. Fig. 4 shows the outside view of the cupola where the blast enters. Fig. 5 shows the back view of the tuyeres as would be seen by looking in through the branch blast pipes at *F*. The two 10″ branch pipes connect to a main pipe 12″ diameter. The length of this pipe from fan to cupola is 85 feet. The blower used is a No. 7 Sturtevant; revolutions 2,100 per minute.

The cupola heat was as follows: For the bed, 648 pounds of coke, upon which was charged 1,200 pounds of iron. The after charges, of which there were nine, were made each of 60 pounds coke and 1,200 pounds of iron.

The totals for the heat were:

Amount of iron melted.....	12,000
" fuel consumed..	1,188
Ratio of fuel to iron used..	1 to $10\frac{1}{10}$

The fluidity of the iron melted was described "hot." As the iron is for castings used in the manufacture of hydraulic oil machinery, the iron would necessarily require to be very fair. The fire was started at 1:15 o'clock; first iron charged, 2:30; blast put on, 3:12; iron down, 3:18; bottom dropped, 4:42. This shows the length of heat to be 1 hour and 30 minutes. J. B. Francis, the foundry foreman, writes that the scrap used was light, and that the blast had to be occasionally slackened in order to allow the iron to be taken care of. For a flux, fluor spar was used, 1 to 10. The iron used was half scrap and pig. The fuel Connellsville coke.

The next cupola is that of the National Iron Works, San Francisco, Cal. W. W. Hanscom, M. E., the designer, gives the following record of heat taken March 24, 1884:

Time of starting fire.....	1:30 P. M.
Charging first iron.....	3:00 "
Blast put on.....	4:37 "
Iron down.....	4:45 "
Bottom dropped.....	6:20 "

CHARGES.

Bed, Lehigh coal, 650 lbs.,		iron,	3,000 lbs.
English coke.....	125 "	"	2,000 "
"	100 "	"	1,500 "
"	100 "	"	1,300 "
"	100 "	"	1,300 "

BLAST PRESSURE.

4:52 P. M.	inches water,	14.2
4:55 "	"	14.8
5:05 "	"	15.2
5:20 "	"	15.6
5:32 "	"	16.4
5:45 "	"	13.4
5:51 "	"	11.
6:00 "	"	8.2
6:13 "	"	5.6

TOTALS.

Iron melted.....	9,100
Fuel consumed.....	1,075
Ratio of fuel to iron.....	1 to $8\frac{46}{100}$
Length of heat, 1 hour and 43 minutes.	

The iron was hot enough for stove plate. Had the work been heavier, so that crane ladles could have been used, faster melting would have been done. Were coke instead of coal used for bed, 525 pounds would be the weight used, thereby making the ratio 1 to $9\frac{57}{100}$. The iron charged was scrap and pig in equal proportions. A No. 5 Sturtevant fan was used; blast pipe, 12 inches diameter and 15 feet long. The size of cupola given is when first lined up. At the time this heat was taken it would be about 3 inches larger diameter. The cupola has melted at the rate of seven tons per hour.

The record of workings for the Niles Tool Works cupola is given as follows:

Time of starting fire.....	2:10 P. M.
Charging first iron.....	3:30 "
Blast put on.....	4:30 "
Iron down.....	4:42 "
Bottom dropped.....	6:05 "

CHARGES.

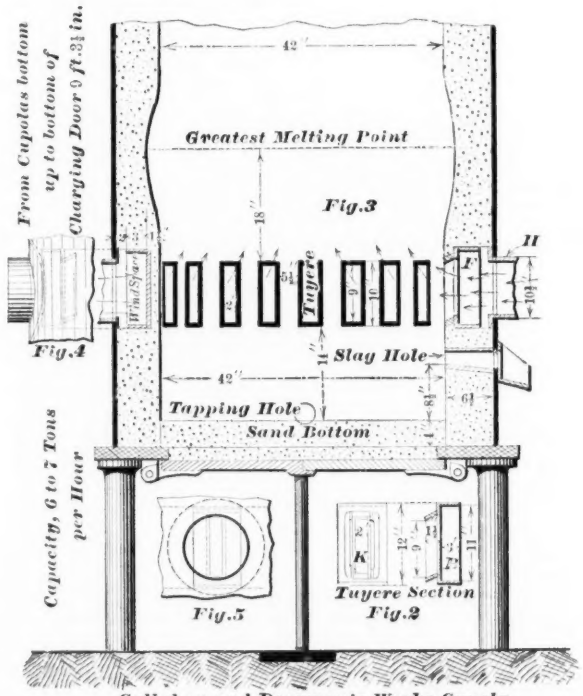
Bed, Conn'lle coke.	1,200 lbs.,	iron,	6,000 lbs.
"	572 "	"	6,000 "
"	572 "	"	6,000 "
"	704 "	"	6,000 "
"	660 "	"	6,000 "
"	572 "	"	6,000 "

TOTALS.

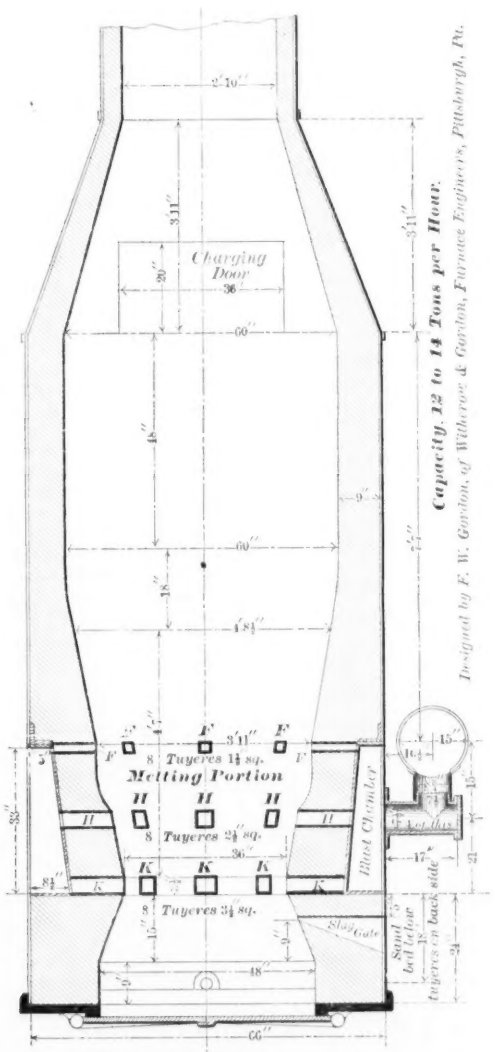
Iron melted.....	36,000 lbs.
Fuel consumed.....	4,280 "
Ratio of fuel to iron....	1 to $8\frac{41}{100}$
Length of heat, 1 hour and 35 minutes.	

The iron is described as being very hot, and the cupola as giving entire satisfaction in both economy and speed. One-third scrap to two-thirds pig iron was melted. The blower is Root's No. 6; revolutions, 125 per minute; length of blast pipe, 25 feet. Fluor spar and limestone used for flux.

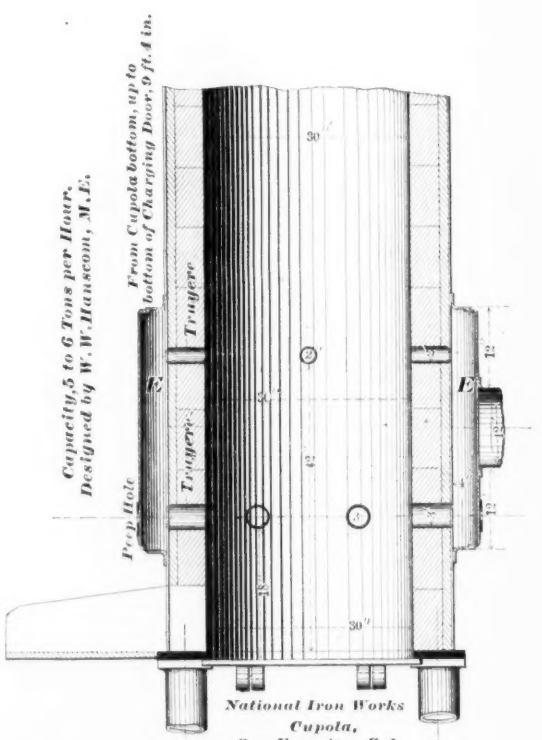
Those familiar with the Colliau cupola know that the area of the upper tuyeres is less than that of the lower ones, and that they incline downwards. It is an evident fact



Callahan and Dearmon's Works Cupola, Dayton, Ohio.


Charging Door
Capacity, 12 to 14 Tons per Hour.
Designed by F. W. Gordon, of Witherow & Gordon, Founder Engineers, Pittsburgh, Pa.
Melting Portion
Tuyeres 1¼ sq.
Tuyeres 2½ sq.
Tuyeres 3½ sq.
Blast Chamber
Slag Gate
Sand bed for tuyeres in back side

Niles' Tool Works Cupola, Hamilton, Ohio.


Capacity, 5 to 6 Tons per Hour.
Designed by W. W. Hanscom, M. E.
From Cupola bottom, up to bottom of Charging Door, 9 ft. 4 in.
Tuyere
Prop Hole

National Iron Works Cupola, San Francisco, Cal.

that in building cupolas with two rows of tuyeres, much depends upon the relative size of the upper and lower tuyeres. Because there are two rows of tuyeres in a cupola is no reason that thorough combustion is taking place. There are plenty of cupolas with one row of tuyeres working with as good and better economy than some with two rows. Whether the fault is in the design or the management is, of course, a question.

Experience with the Fink Patent Lubricator Humbug.

In our issues of March 22d and April 12th, this year, we published a number of letters from prominent establishments who had purchased from Henry Fink & Son shop rights to use a patent lubricating mixture of water, oil, lime, French chalk and potash, upon the strength of representations made to them by one of the Finks, without previously having tried the mixture to test its real value. The testimony of all the establishments writing those letters, including among them The Pratt & Whitney Co., of Hartford; Brown & Sharpe Mfg. Co., of Providence; Detroit Machine Screw Works; Providence Machine Works; Cleveland Machine Works, of Worcester, Mass.; John F. Slater, of Norwich; E. M. Birdsall & Co., of Auburn, N. Y.; Plumb, Burdict & Barnard, of Buffalo; Cambria Iron Co., of Johnstown, Pa.; Schleicher, Schumm & Co., of Phila.; Chicago Screw Co.; L. M. Dayton & Co, of Cincinnati; Bulkley, Dunton & Co., of New York; New Orleans Gas Light Co., and Mr. J. S. Cook, M. M. of the Georgia Railroad, was to the effect that they had been grossly deceived by Fink's representations. In the interest of the mechanical public we have made extensive inquiries, by letter and otherwise, regarding the so-called lubricant, and the methods of introducing it. In this issue we publish several more letters that throw light upon the subject.

It is proper to mention here that the *Oil, Paint, and Drug Reporter*, of New York, *The Manufacturers Gazette*, of Boston, and the *Baltimore Manufacturers Record* have ably seconded our efforts to thoroughly expos this extensive and lucrative humbug.

More Reports from Establishments that had Given Fink Favorable Testimonials.

Newport, Ky., April 7, 1884.

American Machinist:

We received a call from Mr. J. Fink in January last, and, on the strength of his large and voluminous editions of certificates and testimonials from the largest and best known houses in our and other lines, we were induced to purchase a "shop right" for the use of the mixture from him, and a few weeks later, without giving the matter the attention which we should have done, gave him a recommendation of same, from a form submitted by him, and similar to others which he had shown us. Since then, and upon a close examination of the "merits" of same in our factory, we find the patent oil mixture of no value whatever to us.

Yours truly,
The Dueber Watch Case Mfg. Co.,
W. A. Moore, Manager.

Leadville Coal Company,
Ralph J. Wick, Gen. Man.
Youngstown, Ohio, April 12, 1884.

We use the "Fink Lubricating Mixture" on heavy coal bank machinery (which is all the machinery we have in use). In our case we deem the mixture a saving. Have had no experience with the mixture in light machinery, therefore are unable to give our opinion outside of the heavy machinery in use by us. Know of no other concern in this town using the mixture.

Yours truly, Ralph J. Wick.

The Mortgage Trustees of
The Miners' Smelting and Reduction Co.,
Golden, Col., April 13, 1884.

American Machinist:

Mr. Fink called on me to sell me his mixture. I told him I had no use for it. He afterwards sold it to P. R. Smith, manager of the company. Engineers and machinists who have used it here in Colorado told me it was a humbug, so I never took the trouble to try it. Yours respectfully,

Edward O'Neill.

Mr. P. R. Smith, late manager of the same Company, also writes us:

To the best of my recollection we used some of the lubricator mentioned, and it was unsatisfactory.

Louisville, Ky., April 8, 1884.

American Machinist Publishing Co.:

I had but six months' experience with the "Fink Mixture." I found its virtue to be sluggish fluidity, due to partial saponification, and in this respect done well, if for no other reason than its staying qualities. We never succeeded in making the mixture unless using lard oil exclusively. The saving claimed by the mixture is using part water as a lubricant, in union with oil, but whether there is a saving, I cannot state, for reason as above. Yours truly,

A. Stitzel,
Late Superintendent Belmont Distillery Co.

The name of the Dover Stamping Co., of Boston, Mass., having also been given us by Mr. John Fink as having had a favorable experience with his mixture, and given testimonials accordingly, we wrote that concern, asking them to inform us, specifically, as to the various purposes for which the mixture was recommended to them, the purposes for which they had applied it, and those for which they were now using it. We publish their reply entire:

Boston, Mass., April 9, 1884.

American Machinist Publishing Co.:

We have your favor 8th, enquiring about the practical value of the Fink lubricating mixture. Mr. Fink made certain representations in regard to his mixture to us, showed us his many testimonials, also the composition. He offered to permit us to use it if we would allow him a certain per cent. of the saving it should make for us. The negotiations resulted in a purchase.

We have constantly used it from that time until now. We have saved all that Mr. Fink stated we should save. The mixture has performed, so far as we have had occasion to utilize it, all that Mr. Fink claimed for it. He deceived us in nothing. His representations were supplemented by the offer of its use for a share of the amount saved. Nothing could be fairer. After two interviews, at different dates—and a trial of the mixture—the bargain was completed. We had not previously known Mr. Fink, nor do we claim much acquaintance with him now. We are in no wise interested in his success. We remember him as a courteous gentleman, confident of his having a good article, and *urgent*, only to have us use it on trial, as before stated.

We are satisfied with our purchase and with Mr. Fink. Truly yours,

Dover Stamping Co.

You are at liberty to publish this.

D. S. Co.

On receipt of this communication we replied, expressing our regret that we could not find in it the answer to our questions, and saying: "We take the liberty of asking detailed information on this subject, because your certificate has been and is being used by Fink & Son to induce a large number of establishments to purchase the mixture for a great variety of lubricating purposes. In view of the many adverse reports which we have received from such establishments, we think it due to the mechanical public, when invited to purchase on the strength of your recommendation, that it should be distinctly stated, as asked in our letter of the 8th, what are the specific uses for which you have tried the mixture, and to what specific uses are you now putting it?"

We publish below, also entire, the reply of the Dover Stamping Co. to this request:

Boston, April 11, 1884.

American Machinist Publishing Co.:

Our relations to Mr. Fink, as well as our relations to the public, call upon us to say what we did in our previous letter to you. We have said substantially the same thing in our testimonials to Mr. Fink—which are open to the public. We always speak of the bridge that carries us over, whether safely or otherwise. Mr. Fink's mixture was, and is, of value to us; of more value *to-day* than at date of purchase. We repeat that it performed, and still performs, all that was claimed for it, namely—that it would "do our work at a great saving," *and that was all that was promised.* We are not bound to make this mixture do as well in other hands, nor are we responsible for any of its shortcomings. We bought it for *our* works. If Mr. Fink wrongly represented the article to others, we do not know it.

Some of your correspondents denounce Mr. Fink and his mixture—and *justly*, for aught we know. We only speak for *ourselves.* We have no controversy with the public or with Mr. Fink. We do not claim to be public benefactors. Nor do we plume ourselves upon being able to say with propriety that this or that man is wrong. Indeed, we respect the views of others as correct, from their point of observation. "What is one's meat may be another's poison."

Having seen Mr. Fink but three times, twice before, and once since, our purchase of him, we cannot say that he is not the rogue others charge him with being, but his appearance with us was that of a gentleman.

You ask us for a detailed statement of the work performed by this article on our machinery. Not wishing a controversy with those who have not found it a success, we most respectfully decline to furnish the same. We are not advocating the use of the mixture for others, nor are we defending Mr. Fink against just charges made by those with whom he has dealt. His deal with us was honorable. Truly yours,

Dover Stamping Co.

Crescent Mills, Springfield, Mass.,
March 21, 1884.

American Machinist:

Some ten years ago (perhaps a little less) we bought of Messrs. Fink & Son a recipe for a mixture to be used with our lubricating oil, thereby lessening the expense, which mixture we used quite successfully with the oils that we were then using. Lately we have given it up, buying cheaper oils, and finding that the mixture does not work as well as with the higher-priced oils. Our recommendation was given upon the success at the time. We all know that water is as good a lubricator as can be found, if it can only be retained upon the bearings, which it seemed to do then. As to all later inquiries, we have said that we were not now using it.

Yours very truly, Chapin & Gould.

More Unfavorable Experience.

Carnegie Bros. & Co., Limited,
Pittsburgh, March 6, 1884.

American Machinist Publishing Co.:

On June 19th, 1878, our association, then being "The Edgar Thomson Steel Co., Limited," we purchased from Henry Fink & Son one barrel of "patent oil mixture," with right to use for three months, under Letters Patent 127,328, of May 28th, 1872. We do not remember that we used it three days. It was speedily condemned and thrown out.

Nothing further appears on our records, or is recalled, until the same persons, or their agent, endeavored in 1883 to again prevail upon us to give the mixture another trial. We declined, having experience enough.

Of the value of the mixture, as now presented, we can, of course, say nothing; but the so-called "lubricator" sold us in 1878, under the patent cited above, we most emphatically condemn.

Yours truly,
Carnegie Bros. & Co., Limited.

The patent numbered as above is for the lubricating mixture referred to in the various letters published by us.

Office of the Ebervale Coal Co.,
Ebervale, Pa., April 15, 1884.

American Machinist Publishing Co.:

I consider Henry Fink's patent lubricating oil mixture a humbug, as you rightly term it. We gave it a fair trial, and it proved a failure every time. The water would separate from the oil. Mr. Fink solicited a recommendation, but I positively refused to give it to him. I did give him a line to Messrs. Coxe Bros. & Co., of Drifton, stating that we were experimenting with the mixture, but could tell nothing of its merits. This was all, and nothing more.

Yours truly, T. D. Jones, Supt.

Cross Creek Collieries, Coxe Bros. & Co.,
Drifton P. O., Luzerne Co., Pa.

American Machinist Publishing Co.:

We received your letter in regard to Fink's patent lubricator. Some years ago we were induced, by the recommendations he showed us from parties in whom we had confidence, to purchase the right to use it. We tried to, but could not make it work. We then corresponded (as we should have done at first) with some of the parties whom, we had been informed, were using it. We never heard of any one who used it successfully. We charged the amount which we had paid him to profit and loss, feeling that we had learned *something*, but not how to make *lubricants.*

Yours truly, Eckley B. Coxe.

Sawyer Woolen Mills,
Dover, N. H., April 11, 1884.

American Machinist Publishing Co.:

We tried the Fink mixture, and, finding that we had been humbugged, we did not feel inclined to say much about the matter. It is some consolation to know that we are only one of a large and distinguished company of victims.

Yours very truly,
C. H. Sawyer, Agent.

110 Baldwin Street, Elmira, N. Y.,
April 16, 1884.

American Machinist Co.:

Referring to "Fink's patent oil mixture," we would state that we have given it a thorough trial, and have found it of no practical use whatever, and we consider it a decided failure in every respect.

We would further add that our experience is precisely like that of Mr. J. S. Cook, of the Georgia Railroad Co., as expressed in your issue of 12th April.

Respectfully yours,
J. Langdon & Co.
(The McIntyre Coal Co.)

The Lawrence Machine Shop,
Lawrence, Mass., April 21, 1884.

American Machinist Publishing Co.:

Regarding the Fink oil mixture swindle, we would say that we did invest $50 on the strength of letters shown us by Fink, and we could not but suppose it had some merit, if so many had paid for its use. Our experience has been the same as the rest. We tried it thoroughly on various kinds of work, but could see no advantage over water with a little soda in it, and it certainly was not equal to oil alone for screw cutting and drilling. We wrote to Fink & Son at Baltimore that we could not use the mixture, and asking them to refund the $50 we had paid them, they having previously written us to pay them $100 more as the balance due them for the shop right. This we did not do, nor have we received back our $50, which we have charged on our experience account. The whole thing is a clever swindle.

Yours truly, S. S. & W. O. Webber.

Charleston, S. C., April 7, 1884.

Editor American Machinist:

I have decided to join the crusade against Henry Fink & Son, and will say that three years ago one of them sold his mixture to us, which proved to be worthless—would not stay mixed. Last January he came here again and tried to sell it a second time, but one dose of it was enough for us. He also victimized others in this city and State.

Respectfully yours,
W. J. Falconer,
Supt. Charleston Bagging Manufacturing Co.

Stonewall Manufacturing Co.,
Enterprise, Miss., March 17, 1884.

Editor American Machinist:

I have read with much interest in your valued paper of 22d March your article on "A Patent Lubricator Humbug," and must say it is truly a humbug. We bought from Wm. B. Fink, of Henry Fink & Son, the patented humbug recipe for mixing oil, water, lime, chalk, etc., paying him $50 cash, and further agreeing to pay $75 after a three months' trial and the recipe proving satisfactory.

Your article so fully tells the tale of our experience that I will simply say we were badly "sold." Wm. B. Fink was in a great hurry when here to close up a contract, to meet a freight train, to connect with some other train, etc. We bought because we saw from letters he had that many of our friends in the same business as ourselves had done so. When the writer questioned their responsibility and the genuineness of the thing, the young man offered to pay for ten telegrams to parties who had bought, but time was too short to do this, and let him meet his train. They have had the "cheek" to offer to take $60 now for the $75 we will owe them when it proves entirely satisfactory.

Yours truly, T. L. Wainwright, Supt.

Natchez Cotton Mills Co.,
Natchez, Miss., March 31, 1884.

Editor American Machinist:

I was called upon by Mr. Fink, who exhibited two handsomely-bound volumes of certificates of purchases under the letter-heads of the respective firms, which included many of the most prominent East, West and South, and by them I was induced to purchase the receipt for his patent lubricating compound, first stipulating, however, for a return of my money should the compound not prove satisfactory. It did not take long to prove it worthless as a lubricator. As per agreement, I drew on Messrs. Fink & Son, Baltimore, with all the papers attached, which were returned to me, the bank being unable to find them at the address given.

Yours truly, R. F. Learned,
President.

P. S.—This will also apply to the Rosalie Mill, of which I was president at the time.

Ashland, Ky., April 14, 1884.

American Machinist:

We were induced to purchase the right to use Fink's lubricator by seeing the names of numerous firms well known to us who had done so.

Mr. Fink promised to be present when our trial was made, and see that it was satisfactory. This he did not do, nor have we seen him since we handed him our check.

In attempting to use the oil on our locomotives, we found the *water came first* and after that the oil.

We attempted to use it for cutting screws, but could not do so. We found it a failure also as a cylinder oil, and have found ourselves unable to use it with any apparent advantage unless with heavy black oil, and are not sure but what as much more oil is required as equals the water added.

Very respectfully,
Ashland Coal and Iron Railway Co.

We have published the letters received by

us from those who have had experience with Fink's mixture, both favorable and unfavorable, so the mechanical public may have data to judge of its merits.

LETTERS FROM PRACTICAL MEN.

Polishing Hard Rubber.

Editor American Machinist:

In answer to your correspondent, J. G. H., of Lawrence, Mass., that there is very little known in regard to the proper working and polishing of hard rubber, and for the benefit of him and others, I am induced to give my experience on the subject, which has been quite an extensive one. In the first place, the cutting and working to proper shape and form does not differ very materially from some of the hardest kinds of wood, but the polishing is an art that few appear to know anything about; and I give it in detail. After the work of turning or filing is done, emery paper or cloth should be used to remove all tool marks, and is best used dry. After the surface is freed from all scratches, and presents a smooth, even appearance, it should be brushed or wiped quite clean from any of the cuttings or emery. It is now ready for the first polishing material, which is fine ground pumice stone and water, used on a cotton flannel pad or wheel, as the case may demand. Use this until the surface shows a fine, smooth, dead finish. After this it should be carefully washed to remove all the pumice. It is now ready for the third operation, which in nearly all common work is the last finish given, and consists in using putty powder or oxide of tin and water on cotton flannel as before, in place of the pumice stone, which, if properly done, will give the article a fine gloss. In cases where the very finest attainable finish is desired for first-class work, the surface is gone over again with lamp black and refined sperm oil used on the palm of the hand. There is one word of caution, however, that should not be omitted, and that is, the greatest care is always to be exercised to avoid heating the work when polishing, as that would destroy all.

W. S. HARRIS.

Centrifugal Force.

Editor American Machinist:

The late discussions in the AMERICAN MACHINIST on centrifugal force seem to indicate that our engineers have dissenting opinions on a subject on which no difference of opinion should exist. I trust that neither Mr. Porter nor Mr. Trautwine will object to the following:

Moving matter has the tendency to continue its motion in a straight line. The direction of motion can be changed only by the application of a force forming an angle with the line of motion. If this force is at right angles with the direction of motion, it does not alter the rate, but only the direction of motion. If the force forms an acute angle with the direction of motion, the motion is accelerated as well as changed in direction. If, on the contrary, the said angle is obtuse, the change of direction is accompanied by a retardation. If matter is required to be moved in a circular path at a uniform speed, this result can only be reached by applying a force which is at right angles to the line of motion, and this force is called the centripetal force. If this force is not strictly radial, it will cause a change of velocity. When this radial force ceases, the motion ceases to be circular—it becomes rectilinear.

In a fly-wheel or grindstone, in order to keep the particles of the rim in a circular path, a strictly radial force must be supplied by the cohesion of the material, hence the material is strained *radially* by what is termed "centrifugal force." As soon as the centripetal force ceases to exist (by a rupture), the motion of the particles will cease to be circular—it will be rectilinear; hence the particles will continue their motion in a tangential direction.

If centrifugal force is that force of inertia which must be overcome by the centripetal force in order to produce circular motion, then centrifugal force is strictly radial. If, on the other hand, centrifugal force is defined as the tendency of moving matter to continue its motion in a straight line from the moment the previously existing centripetal force ceases to exist, then centrifugal force is strictly tangential.

Since, however, the tendency of matter to continue its motion in a straight line is termed "inertia," the latter definition of centrifugal force is, in my opinion, out of question.

The definition of centrifugal force in Trautwine's pocket-book is defective only in so far as the expression "tends to fly off in a radius" is apt to induce miscomprehension. Centrifugal force (like its cause, centripetal force,) exists only as long as the body is not flying off, but continues to revolve round a center. A careful perusal of the definition will, however, exclude the possibility of that error.

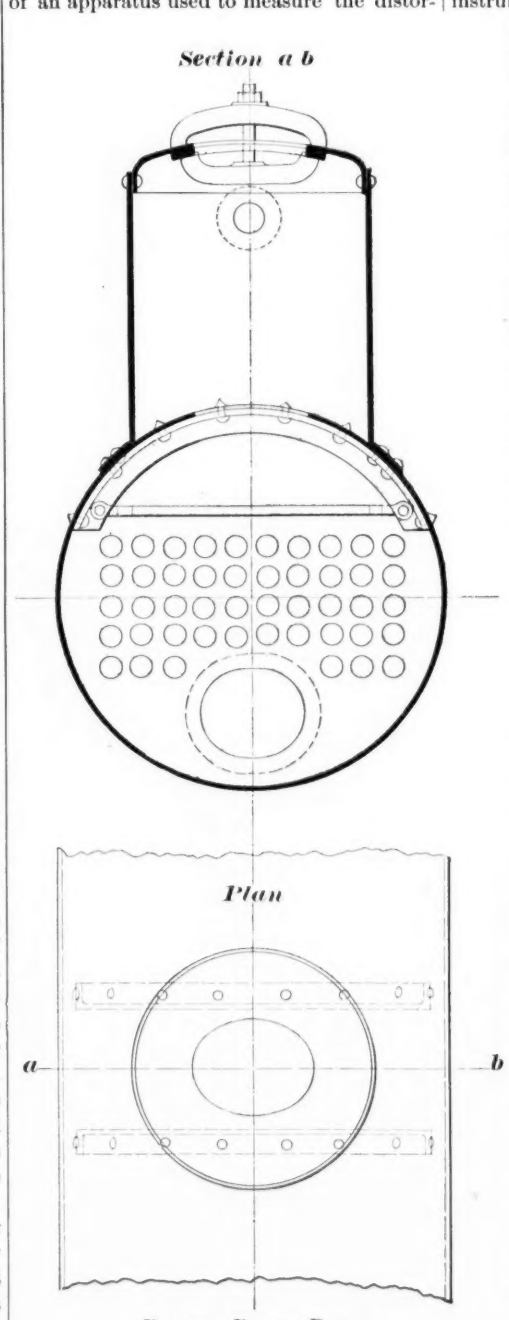
HUGO BILGRAM.

Philadelphia.

Bracing Boiler Domes.

Editor American Machinist:

Referring to the cut and description which appeared in a recent number of your journal of an apparatus used to measure the distortion of a boiler shell at the junction of its dome, and the means taken to prevent it, I offer you the sketch and description of the plan adopted by the Port Richmond Iron Works to stiffen this weak place in boilers.



BRACING BOILER DOMES.

Several years ago (1877) a horizontal tubular boiler, 48 inches diameter and 18 feet long, having a dome of 30 inches diameter, built at these works, soon after being put into use, commenced to leak where the flange of dome joined the boiler. Recaulking proved to be a temporary cure only. A short study of the subject convinced us that the cause was flattening of the shell within the dome, and the consequent strain upon the flange of dome, which had been fitted and riveted to a cylinder which, under internal pressure, became an oval. The obvious remedy was to compel the shell to retain its cylindrical shape, and for this purpose two angle bars 3″×3½″ were bent so as to fit the interior of the shell beneath the dome. These bars were of sufficient length to extend beyond the flange of dome so as to take two or three rivets. Rivets were also inserted in those portions within the dome at intervals of six inches. A tie was secured to the ends of the angle bars to hold them in shape and which could be removed to give freer access from man-hole to ends. No further leaking took place, and the result proved to be so satisfactory that all the boilers of this type built subsequently at these works were so stayed. It is quite probable that other builders use so obvious a means to strengthen this weak part, but if so I am not aware that any publicity has been given to it.

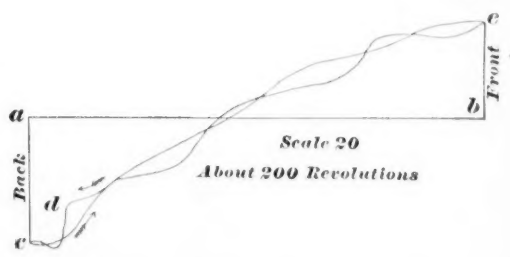
WASHINGTON JONES.

Philadelphia.

Diagram Representing Inertia of the Reciprocating Parts of a Steam Engine.

Editor American Machinist:

The inclosed diagram was drawn by an instrument attached directly to the cross-head of a Porter-Allen engine at Philadelphia post office, and shows the amount and distribution of inertia developed by the movement of the reciprocating parts of that engine at that time. The fact that the weight of reciprocating parts greatly modifies the distribution of pressures upon the crank-pin has been brought prominently to notice by Porter, Hoadley, Professors Sweet and Thurston, and by others; and they have estimated and drawn according to mathematical processes what were supposed to represent these forces of acceleration and retardation under stated conditions. Their processes are doubtless correct as far as they go, but are based on the supposition that there is perfect rigidity in all the parts; that all the bearings are of such a nature that no motion, however small, is allowed in a lateral direction; and allowing no springing of main shaft or other parts that would cause the crank-pin to travel in any but a mathematically correct circle, at the same time compelling the piston to move in a manner more or less modified by the length of the connecting rod from a theoretical movement, supposing the rod to be infinite in length.



It is a fact, however, that the piston does not move under these purely theoretical conditions, on account of springing of shaft and crank, looseness of bearings, counter weight in crank disk, distribution of steam pressures, etc.; and that, in order to calculate the *true* distribution of inertia strains, it would require mathematical calculations entirely too difficult for even our greatest physicists.

The writer, feeling the need of an instrument which would, in a practical way, determine the *true* distribution of inertia forces, has designed and applied the instrument by which the enclosed diagram was taken, and has named it the "inertia instrument." I shall attempt but a meager description at present.

The inertia instrument, as I have said, is attached directly to the cross-head, and travels directly with it. In this instrument there is a weight, the movement of which is opposed by a spring of known force; and a pencil is attached to it, also, by a marking-lever, bell-crank, etc., so that any movement of the weight against the spring causes a multiplied movement of the pencil upon a paper, which has a reduced motion coincident with that of the piston. In this way a diagram is drawn, as presented.

In this case a two-pound weight was used in connection with an eighty-pound indicator spring, and the multiplication of pencil movement was four to one of the weight.

Forty pounds actual pressure upon an eighty-pound spring will compress it one-quarter inch, causing a pencil movement of one inch. Now, if the same spring be placed in the inertia instrument, and a two-pound weight attached to it, a pencil movement of one inch will indicate, as before, an actual pressure of forty pounds, or a force equaling twenty times the body's own weight. That weight being two pounds, the scale of the diagram may be called twenty, meaning that a pencil movement of one inch indicates a force equal to twenty times the body's own weight.

The line *a b*, is the neutral line, and is drawn while the instrument is at rest. The lines *c*, *c*, were drawn while the engine was running at about 200 revolutions per minute. I say "about," as the speed was not timed, but judged to be about 200 by the action of the governor. At an early day I expect to take cards, which will be noted accurately. At the point *d*, the inertia forces were overcome by the steam forces, causing a more sudden retarding movement than that which would have taken place under purely theoretical conditions, as above named.

My greatest object in applying this instrument was to get at a more thorough understanding of the true condition of affairs in any desired case, and using the information thus obtained in making the engine run quietly. Besides, I wished to prove in a practical manner the deductions of Porter, Hoadley, and others.

The diagrams as drawn by the instrument seem to prove the accuracy of their calculations, and, in addition, show the modifications imposed by actions not considered by them. It demonstrates the fact that a true conception of the distribution of pressures upon the crank-pin cannot be obtained without the combined evidence of the inertia instrument and indicator. The new instrument furnishes a new field for thought, and its revelations should enable the engineer to determine scientifically important matters concerning the performance of steam engines, which have heretofore been subjects of conjecture, experiment, and expense.

ED. F. WILLIAMS.

Fine Measurement.

Editor American Machinist:

M. C. K., in a recent issue of the AMERICAN MACHINIST, says he worked in a shop where they made $\frac{1}{1000}$ of an inch, and made the tools to measure it with, but that he has got to learn the importance of such measurements.

I have a Brown & Sharpe micrometer caliper that I have frequently tested by hardened plugs made by another firm, and I find no difficulty in setting it to the $\frac{1}{1000}$ inch.

Did M. C. K. ever have to turn press fits, say several shafts to fit holes all the same size? If he ever did he would have learned the value of fine measurement. If he got the first one too tight he would have found the value of knowing how to measure $\frac{1}{1000}$ inch, and turning the next shaft smaller by that amount. I think M. C. K. is further from being right than his three inch standard. One thousandth of an inch is a very common measurement in these days.

CROSS-FEED.

The New York Central Railroad Company are moving their locomotive repair shops from Forty-third Street, New York, to the old Hudson River shops at Thirty-first Street. All freight locomotives on this division will be repaired at the Thirty-first Street shops besides the passenger and shifting engines that are now repaired at Forty-third Street. Mr. P. M. Gibson, master mechanic, will have charge. The present shops at Forty-third Street are to be pulled down and the ground used for station purposes.

Train-Operating in England.

In a private letter to a member of this office, Mr. Clement E. Stretton, consulting engineer, Leicester, England, a gentleman prominently associated with railway operating in Britain, gives the following succinct account of how railways are operated: In this country all important lines are parties to the Railway Clearing House system, and adopt the same code of rules, therefore one rule book may be taken as the standard upon which all work. All tickets issued over more than one line are sent to the Clearing House; there the officials calculate the miles run over each line, give to each company its share of money, and at each end of the year clear up, and any money due from one company to the other is paid. In the same way through carriages sent over two, three or four lines all go into Clearing House, each company being allowed its share of cost, profit, etc.

The underground railways of London are in two positions; one belongs to Metropolitan, the other to Metropolitan District Railway Company. But the North-Western, Midland, Great Northern, Chatham, South-Eastern, South-Western, in fact all London lines run trains over some portions of Underground Lines. To give all a fair chance is no small job, but we say first come first served, so train first at the junction takes first turn. The line is all worked on absolute block system, and as the block sections are not more than a mile in length, and many only 300 to 400 yards, it follows that they are soon clear of one train, and another follows. In fact, passenger trains follow all day as fast as they can for 18 hours, and the other 6 hours goods trains run as close as possible. Repairs have to be done as much as possible when there is a lighter traffic on Sundays. The fastest train in England is Great Western, London to Swindon, 77¼ miles in 87 minutes, over 53 miles an hour.

On underground lines, also on North London, trains do not stop at stations more than 15 to 25 seconds. Off as soon as possible. They have Westinghouse or Vacuum Brakes in use.

Caldwell's Variable-Speed Chain Hoist.

The chain hoist illustrated on this page is the invention of Mr. John A. Caldwell, of Bay Ridge, Brooklyn, N. Y. The machine is manufactured in a variety of sizes, having lifting capacities ranging from 500 to 20,000 lbs., and is possessed of features which are entirely new in this class of machinery. The operator has a choice of two speeds in hoisting, one speed being double the other, and in lowering, the speed automatically changes to one four times faster than that adopted in hoisting. Thus in a three-ton hoist the slow hoisting speed (or velocity ratio) is 164 to 1, and the quick speed is 82 to 1, and in lowering the speed changes to 41 to 1, and 20½ to 1, respectively.

The principal parts of the machine are a central shaft *A*, Fig. 3; a pinion *B*, loose upon the shaft, and provided with a right hand one way clutch; a distance piece, or pinion carrier, *C*, provided with a left hand one-way clutch, and two studs, *D D*, upon which two pinions *E E*, turn loosely, and the two lift wheels *F F*, each fitted with internal teeth or cogs, one wheel having a tooth or two more than the other.

The working of the machine may be best understood by referring to Fig. 4, which is a side view, with one of the lift wheels removed to show the gearing in place. Motion is communicated to the central shaft, and by means of the clutch *P*, on the shaft to pinion *B*, by pulling on one side of the hand chain, four revolutions of the central shaft and pinion, giving one complete circuit or convolution of the pinions *E E*, around the central pinion, sun and planet fashion. In doing so they develop a slow motion in the lifting chain wheels in opposite directions, each lift wheel moving a space equal to half the pitch of one tooth for each convolution. So that in a hoist containing twenty teeth on one, and twenty-one teeth on the other lift wheel, there is developed $20\frac{1}{2} \times 2 + 416 \times 4$ to 1 as the nominal or greatest lifting capacity of the machine.

If one lift wheel is held fast upon the shaft and the other is allowed to revolve, the speed of the moving wheel is instantly doubled, with the same speed of hand chain. This is taken advantage of, and the pawl *R*, provided, as shown which, when thrown over from the position shown, engages the links of one part of the chain, holding it fast, while the other does the hoisting and lowering at double the speed as before, with of course only half the power.

Reference to Fig. 3 will show how the speed changes automatically from slow in hoisting to four times faster in lowering, with same speed of hand chain. In hoisting, the clutch marked *P*, which is a part of the central shaft, is in *direct* engagement with the central pinion *B*, and, as before explained, four revolutions of this pinion give one convolution to the pinions *E E*, and half a tooth of movement to each of the lift wheels. It is evident if the pinions *E E*, made *one* revolution for *each* turn of the central shaft, instead of one convolution for each *four* turns of the shaft, the operation of the lift wheels would be four times faster, with a given speed of hand chain. This is done automatically when the chain is pulled the reverse way from that of hoisting, by the clutch *P* leaving engagement with the central pinion *B*, and by a longitudinal movement going into engagements directly with the pinion carrier *C*, leaving pinion *B* to run around as an idler for the time being. This operation takes place at each change from lowering to hoisting, and *vice versa*.

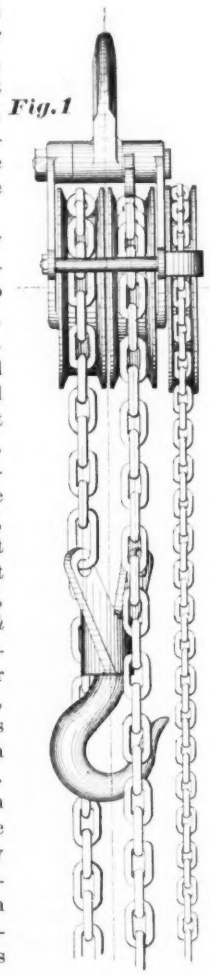


Fig. 1

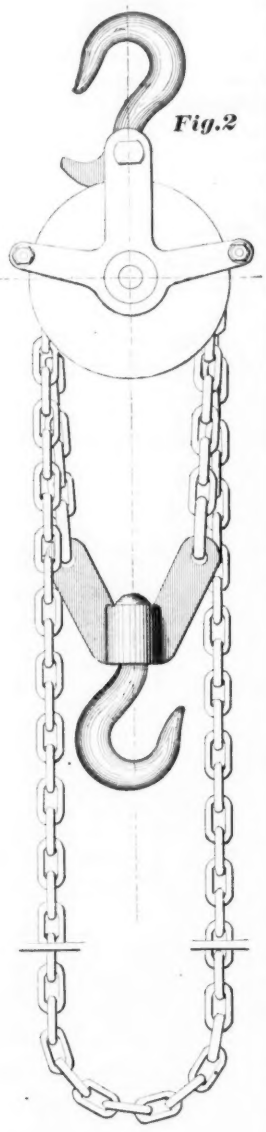


Fig. 2

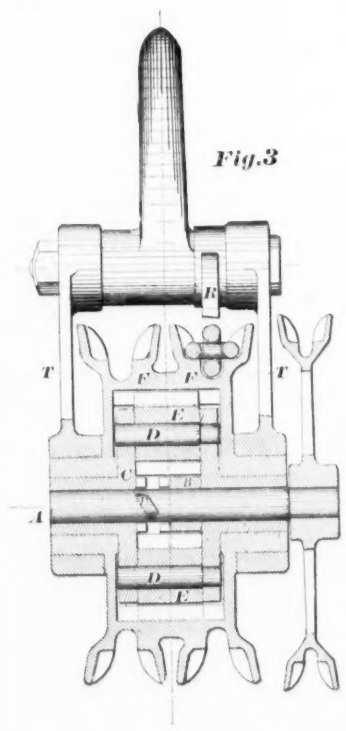


Fig. 3

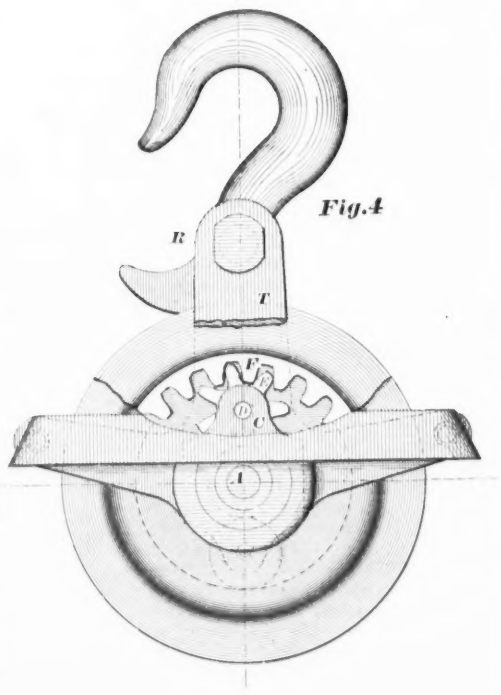


Fig. 4

These four changes of speed are effected without adding a single pound of metal to the machine—a most desirable end.

The load is entirely suspended by the slow-moving hubs of the lift wheels and the side frames *T T*, leaving the fast-moving parts perfectly free from "load friction." By moving the chain with the load upon it slowly, it is claimed that the correct principle in hoisting is carried out, producing the minimum of friction.

The lift chain wheels are large, thus presenting proportionately more wearing points.

The gears are machine cut and operate smoothly like the ordinary crab winch.

The manufacturers in this country are the Stow Flexible Shaft Company, Limited, of Philadelphia, Pa.

How Being a Mechanic Served a Merchant.

Mr. W. H. Wallace, head of the iron plate manufacturing firm of Wallace & Co., who is a self-made man, attributes a great part of his business success to the fact of his being a practical mechanic. Speaking of the advantages he received from the ever-available trade knowledge which he derived from his experience as a mechanic, Mr. Wallace related the following anecdote: He had sold a large quantity of plate iron to a boiler-making firm, and a report was returned that the iron would not flange. Mr. Wallace knew that there should be no difficulty about flanging the iron, and he walked into the shop to see the flanger at work. A short time of observation convinced him that the man who was entrusted with the job of flanging was misusing the iron. Mr. Wallace told the man his impression, and was disposed to take off his coat and show how the work should be done. This was not necessary, for the flanger saw that Mr. Wallace could not be deceived, and there was no more complaint about that iron not flanging. Undoubtedly such complaints which we frequently hear at the present time would be rarer if more iron merchants were able to demonstrate personally wbether or not their iron would flange.

Mrs. Norah Killeen, a widow, living at Oil City, Pa., wishes to obtain information regarding the present whereabouts of her son, Henry Killeen, who left home about a year ago, and has not since been heard from. He is a machinist, and about twenty years old. We publish this item as an act of kindness, and trust that it may be the means of bringing the distressed mother news of her absent son.

Extended Smoke-Box and Brick Arch.

On this subject Frank C. Smith writes us:

"The extension smoke arch is coming largely into use in the South, with the usual good results. Mr. Carson, Master Mechanic of the Mobile and Ohio Railroad, uses in place of the brick arch in the fire-box, a box or water table of boiler iron, shaped the same externally as the fire-brick arch, and attached to the crown and flue sheets by four 2-inch pipes, the object being to make an indestructible arch, and one which will not be ruined in case of a flue bursting, as is the case with the fire brick arch. I notice many fire-brick arches are put in by bolting angle iron to the side sheets, the arch being of curve formed bricks, and held in position by a groove in the foot of each brick slipping into the angle iron, the whole held in place at the crown by a key, which is simply a piece of two-inch wrought iron pipe, which slips into place in a half-round groove formed in each half of the fire-brick. Many Southern roads prefer, where the ordinary pipes are used to support the fire-brick, to fasten their pipes into the back or door sheet, in place of the crown sheet, by expanding them the same as a flue, a hole opposite in the boiler head allowing of the use of an expander, as well as for washing out the pipes. The front ends of the pipes are also expanded in the flue-sheet.

"The complaint of many roads is that they do not get as great economy from the use of the brick arch and extension-smoke arch as they expected, but all say they would not do without it, owing to the less number of sparks thrown and the great decrease in black smoke. They also notice that the economy improves as the firemen and engineers become accustomed to its use. There is undoubtedly a certain amount of economy resulting from its use, as owing to the straight shoot of the exhaust, unimpeded by netting or cone, it is always found that in the ordinary engine, where a 3-inch nozzle is used, the addition of the arches allows of a 3½" or 3¾" nozzle, which necessarily reduces the back pressure and pulls less sparks from the fire. The value of the arches depends on the quality of the coal. With poor, slaty coal it shows remarkable economy, which decreases as the quality of coal is better. On one road I found tests showing 20 per cent. economy over the ordinary engine, the coal being very poor and slaty. Within five miles was another road using the arches from the same drawings, where tests showed but 4½ per cent. better than the ordinary engine, the coal being equal to any in the States. I have looked into the merits of this device, and I think its great advantages are the throwing of less spark and the doing away with so much black smoke. Ordinarily, on a passenger train, after each fresh fire, if the door is left slightly ajar, a grey colored smoke escapes from the stack for about 100 feet, when it changes to white steam, until the next fire. It would appear that if careful tests were made a better economy would be shown than is generally accredited to the use of the arches, as it frequently occurs that by their use an engine which, previously would not steam with more than a 3-inch nozzle, will make plenty of steam with no nozzle at all. This means a marked reduction in back pressure, and if there is anything in the teachings of steam engineering, a reduction of back pressure is conducive to economy."

Laying Out Link Motion.

BY J. G. A. MEYER.

FIRST PAPER.

Fig. 1 is an outline of a link motion such as is generally applied to the American locomotive. It can be adjusted to control the movement of the slide valve in such a manner that equal portions of steam will be admitted alternately at each end of the cylinder.

In the following article we propose to explain how this can be accomplished:

Although we would not advise any person to be satisfied with approximate rules or constructions, yet cases do occur where the approximate constructions, being so very near correct on account of their simplicity, are of greater practical value than the application of the rigid and more difficult theoretical rules.

By these remarks we do not wish the reader to understand that the following constructions are all done according to the rules of thumb—not by any means; for all, with the exception of a few points, are theoretically correct. At the end of this article we will point out those points which are, and which are not, approximately found, so that the reader may feel satisfied that our construction may always be relied upon as being correct for all practical purposes.

In what follows the cylinder will always be regarded as lying on the right-hand side of the axle, the link being between cylinder and axle, and the axle located in the center of pedestal.

To avoid any misunderstanding, we will explain the meaning of some of the terms used:

The length of crank is the distance from center of axle to center of crank-pin.

For convenience, we shall call the total distance from center of eccentric strap to the center of eccentric pin in the link the length of the eccentric rod.

The throw of eccentric is the distance from center of axle to center of eccentric wheel.

The length of the connecting rod is the distance from the center of crank-pin hole to center of cross-head pin hole.

The length of link hanger is the distance from center to center of holes.

CONDITIONS.

Since this article only treats on the adjustment of the link motion, the following items are supposed to be known and established: The lap of valve, which in this case will be three-fourths of an inch; the throw of eccentrics, 5 inches; the stroke of the piston, 24 inches; the position of the rocker, as per Fig. 1; the length of the rocker arms, which are in this case of equal length; length of link hanger and all dimensions of link, complete, as shown in Fig. 1; and also the length of the connecting rod.

The adjustment of the link motion may at first sight appear to be a difficult problem, as we must have a knowledge of the relative motions of the piston and slide valve, but by reducing this problem to several elementary problems, so that the laws governing the relative motions may be discovered and clearly defined, a clear conception of our subject can be gained, and the solution of our original problem can be accomplished with comparative ease.

In order to find what kind of elementary problems are applicable, let us suppose that we are looking at a locomotive with a link motion, as shown in Fig. 1, applied and correctly adjusted. Now let us examine it, commencing with the valve. We find that the valve receives its motion from the upper rocker arm, and this receives its motion from the lower rocker arm. According to our conditions, previously stated, both of the rocker arms are of the same length, and, therefore, the arc described by the upper rocker arm will be the same length as the arc described by the lower one. We also notice that the link which moves the lower rocker arm is held in position by the lifting shaft arm. The question, then, will naturally arise, must this lifting shaft arm have some particular length, and the center of lifting shaft have some particular position? We answer "Yes," and this is one of our elementary problems to solve. Again, we notice that the saddle-pin is not in the center of the link, and we ask again, why? To answer this will be another elementary problem. The next we notice are our eccentric rods. These we find, on examination, to have some particular length, and to find this length is another elementary problem. Next we examine our eccentrics; these, we find, are fastened to the axle, and since the crank is also fastened to the same axle, it follows that there are some relative positions between them; to find these positions is another elementary problem. Now let us look once more at the rocker, and we find that the two rocker arms are not in the same straight line; hence, to find the amount of off-set is another elementary problem. And lastly, we must be able to find the position of crank-pin to correspond with the position of piston when at full stroke at either end of the cylinder, and also when at half stroke moving in either direction.

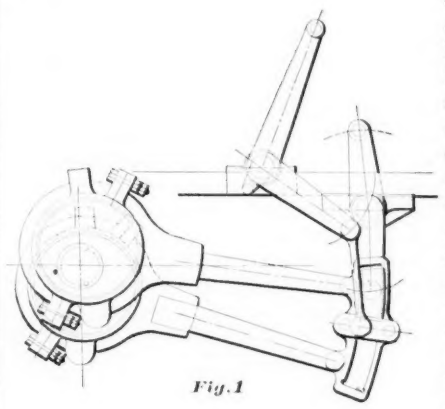


Fig. 1

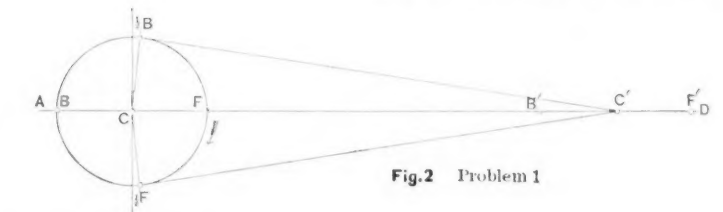


Fig. 2 Problem 1

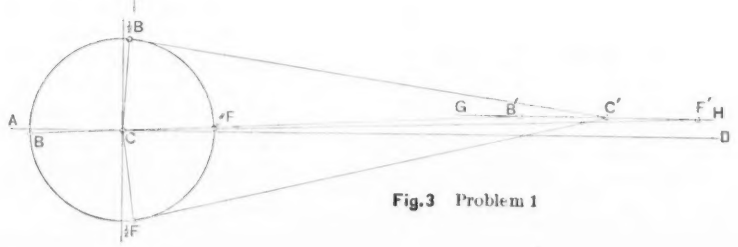


Fig. 3 Problem 1

Here, then, we have all the elementary problems that are necessary to understand for the solution of our original problem.

We will now explain all these problems in an order the reverse to that in which we stated them; hence we have the following order:

1st. To find position of crank at full and half stroke.

2d. To find center line of motion and amount of off-set in rocker arms.

3d. To find relative positions of crank-pin and eccentrics when at full and half stroke.

4th. To determine the correct length of eccentric rods.

5th. To find position of saddle-pin.

6th. To find the position of the center of lifting shaft and length of arms.

Problem 1, Fig. 2 and 3. To find the position of crank when the piston is at full and half stroke. Let the center of wheel and the axis of the cylinder be in the same straight line as, *A*, *D*, Fig. 2. With any point *C*, as a center, and a radius equal to the length of the crank describe a circle *F*, ½*F*, *B*, ½*B*, and let us call this the crank pin circle. The straight line, *A*, *D*, intersects the circumference of the circle in the points *F* and *B*. The point *F* will be the center of crank-pin when piston is at full stroke at the forward end of the cylinder, and point *B*, will be the center of crank-pin when the piston is at full stroke at the rear end of the cylinder. With the point *F*, as a center and with a radius equal to the length of the connecting rod describe an arc intersecting the line, *A*, *D*, in the point *F′*, with the point *B*, as a center, and with the same radius describe an arc intersecting the straight line *A*, *D*, in the point *B*,′ and with the point *C* as a center, and with the same radius describe an arc intersecting the straight line, *A*, *D*, in the point *C′*. Point *F′* will be the center of cross-head pin when the center of crank-pin is at *F*, and *B′*, the center of cross-head pin when the crank-pin is at *B*, and the point *C′* will be the position of center of cross-head pin when piston is at half stroke. With point *C′*, as a center, and a radius equal to the length of the connecting rod describe an arc passing through the point *C*, and intersecting the crank-pin circle in the points ½ *F*, and ½ *B*, these points will be the position of crank pin when the piston is at half stroke, or when the center of cross-head pin is at *C′*.

It often happens that the axis of the cylinder is above the center of axle. When such is the case we must follow the construction as shown in Fig. 3. Let two inches be the distance that the center of axis of cylinder is above the center of axle.

Draw a straight line, *A*, *D*, through the center of axle *C*, two inches above this draw a straight line, *G*, *H*, parallel to *A*, *D*; this line will then pass through the axis of cylinder. With the center of axle *C*, on the straight line, *A*, *D*, as a center, and a radius equal to the length of the crank describe a circle *F*, ½*F*, *B*, ½*B*, this circle will be the crank-pin circle. With the point *C*, as a center and a radius equal to the length of the connecting rod, plus the length of the crank, describe an arc intersecting the straight line, *G*, *H*, in the point *F″*, this point will be the position of the cross-head pin when the piston is at full stroke forward. Through the points *F″* and *C*, draw a straight line, intersecting the crank-pin circle in the point *F*; this point will be the position of the center of the crank-pin, when the piston is at full stroke forward. Again, with the point *C*, as a center, and a radius equal to the length of the connecting rod minus the length of the crank describe an arc intersecting the straight line, *G*, *H*, in the point *B′*, this point will be the position of the center of the cross-head pin when the piston is at full stroke in the rear end of the cylinder. Through the points, *B* and *C*, draw a straight line intersecting the crank-pin circle in the point *B*; this point will be the position of the center of crank-pin when the piston is at full stroke in the rear end of the cylinder. Find a point, *C′*, exactly central between the points *B′* and *F″*, on the line, *G*, *H*, in other words, bisect the distance, *B′*, *F″*, by the point *C′*. With the point *C′* as a center, and a radius equal to the length of the connecting rod, describe an arc intersecting the crank-pin circle in the points ½*B* and ½*F* these two points; will be the center of crank-pin when the piston stands at half stroke. In the link motion, as shown in Fig. 1, the axis of the cylinder is supposed to be 2 inches higher than the center of axle. For this reason the construction shown in Fig. 3 will hereafter be used.

A new reason for paying such prices for railway equipment that the manufacturers can afford to use first-class material and workmanship was developed by a recent occurrence in a Western city. Two railway companies got into a dispute about the right of way over a certain track, and proceeded to settle the difficulty by a duel between two locomotives and freight trains. The contesting engines butted each other mercilessly for an hour or two—the heavy trains coming together repeatedly with a crash. At last, however, several cars in one of the trains began to break up. They were too cheap to stand that sort of usage. The result was that the other train held the field in triumph while its defeated opponent had to retire to seek the cripple track and the repair shop. If the unsuccessful side had only been willing to pay higher prices, and thus get stronger cars, they might have been the victors—*Railway Age.*

Compliment to American Technical Schools from a British Scientist.

At the annual dinner of the Institution of Civil Engineers of Great Britain, held in London March 26, some of the most illustrious men in science, art, and education were guests and speakers. Among the guests we observe the name of Mr. Coleman Sellers, of Philadelphia. In replying to the toast, "The Chief Seats of Learning of the United Kingdom," Sir Lyon Playfair, M. P., who has for years figured as a leader of liberal education, paid a high compliment to the Boston School of Technology. Most American readers will readily excuse the mistaken views which Sir Lyon holds in regard to the future of our free trade policy, since they were expressed in connection with admiring words for our representative technical institutions. After telling of the gratifying progress made in Britain in the interest of technical education, Sir Lyon Playfair said: "I have visited probably every technical school in Europe, as well as many in America, and I may say there is not one school in this country that may be considered a fully-equipped technological school, fitted to teach the industrial arts in the complete and full way in which they are taught abroad. I happen to spend every autumn in America. America knows that it must compete with us before long with regard to our industry. Its protective tariff cannot long exist, and they are establishing the most complete technological colleges in different parts of the United States to be ready for this competition. In the technical school at Boston there is not only the most complete equipment for persons intending to go into every art—the mechanical arts, the chemical arts, and other arts connected with the industries of the country; the laboratories are not only fully equipped, but the education is of the most complete character. They have not only schools of design, but they carry the design into engraving and wood-cutting, and actually into the dyeing of the textile fabric. They are founding laboratories connected with the cotton trade, in which every scientific application with regard to cotton industry will be taught. They have machine shops in connection with the Boston school, of the most complete and equipped character. We have nothing in this country to compare with them."

From the particulars given in a recent consular report, we are convinced that Paraguay, like other South American States, is entering on the way of material progress. The greater part of this century has been wasted in political conflicts, but the people now seem to have settled down with the purpose of developing the natural riches of the country. In its new departure, says the report, the first great want of Paraguay is population. The accession from Europe of a few thousand skilled workmen, who, unlike the present degenerate masses, are willing and ready to take advantage of their opportnities, would speedily make their labor felt upon the fortunes of the nation, and with it capital to develop the waiting riches of the country would soon begin to flow in. Without an increase of men and capital, the progress must continue to be slow.

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AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.

JACKSON BAILEY, Vice-Pres't.

LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, ANGUS SINCLAIR, } Mechanical Engineers.

The American News Company,
Publishers' Agents, New York.

The International News Company,
11 BOUVERIE STREET (Fleet Street), LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage prepaid.

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NEW YORK, MAY 10, 1884.

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Supplying a Demand.

Prejudice has a good deal to do even with as enlightened a business as that of the machinist. Sometimes a manufacturer is, naturally enough, impressed with the idea that the best place to sell good tools and machines is where they are needed most, that is where they are using poor ones, but in the end finds that it requires more missionary work than he is prepared to engage in, and comes to the conclusion that it is easier and more profitable to sell to those who know the advantages of such things by experience.

Old tools and obsolete machinery stand in many places like old friends—not to be lightly put away in favor of something new. After all, the old engine turns over, which is just what the new one will do, or the old lathe runs with a belt just like the new one. These are arguments that cannot be opposed, and are sometimes conclusive.

More than one machinist, looking around for an opportunity to start in business in a moderate way, has come to the conclusion that his best opportunity was where his work and tools would be a hundred per cent. better than anything there, and found in the end that he had a hard job to get a chance to compete with old tools and methods with which every one was familiar. This is not mere fancy, as many have found out through an unpleasant experience. When a man is thoroughly satisfied that he can get along with poor work, done in twice the time that it ought to be done in, argument in favor of something better is wasted on him. It is more fruitful to talk to the man who is not satisfied. The demand for better things comes from those who are never entirely satisfied with what they have.

There are localities where the best classes of steam engines find no sale, as well as those where none others are used. And so it is sometimes with machine tools, and to some extent with the work done with them. "Yankee" tools, "Giltedged" and "High toned" are terms sometimes used to express ignorance of the qualities of design and workmanship. It is valuable work to reform opinion in such places, but it is not an easy thing to do.

In supplying foreign demands, prejudice has to be carefully studied. It is what those who buy think they want, and not what the manufacturer knows they ought to have, that must be supplied. In the end, it is to be expected that everywhere the best will reach the head, but the end may be so far away as to make it useless to work for it, except in a spirit of pure benevolence, in favor of succeeding generations. The question of supply and demand is always the important one, only demand must generally come first. When the demand is for the best that is to be had, the manufacturer who supplies such, or the machinist who proposes to do good work, finds an opening, because he can supply the demand. When the reverse of this is true, the supply must be of another kind.

Refuge for Foreign Shipowners.

A strong effort is being made in Congress to pass a bill to enable a steamboat company to purchase foreign vessels and register them under the American flag. This scheme has been before Congress in some form or other for ten years; but, although hidden under numerous disguises, the friends of American industries are not prevented from recognizing the cloven hoof of free trade. If any company really wishes to go into the carrying trade, they can now have iron ships built more cheaply in American yards than they cost in the Clyde when the cry for free ships was first raised. But the parties who are engineering schemes to legally register foreign-built ships under the American flag have no intention of establishing any line of American boats; the job is merely worked in the interest of foreign shipowners. Every few months European shipowners are terribly convulsed with the sight of war clouds among the nations, and their great and crying need is a city of refuge under a neutral flag, to which they could safely retire when the belligerent countries begin to destroy the property of each other. The United States has no European policy, nor any other foreign policy, so there seems little fear of this country going to war. How convenient it would then be, when a European conflict begins, for the ships belonging to the disputants to join the American merchant fleet! These foreign shipowners would become fond of Yankee domination all at once, and our merchant marine would grow as rapidly as it disappeared during our own late unpleasantness. Then, when smiling peace returned, our fleet so formed would vanish as quickly as it appeared.

The Fastest Ocean Steamer Afloat.

In the AMERICAN MACHINIST of November 3, 1883, in giving a brief description of the steamer Oregon, just arrived on her maiden trip, we said: "This vessel was built specially for speed, and the first trip indicates that the intention of the owners to make her the fastest vessel afloat is not likely to meet with disappointment." Our anticipations in this respect have proved well grounded, for the Oregon has just made the fastest run ever made across the Atlantic. The passage was made between Queenstown, Ireland, and Sandy Hook in six days, ten hours and eight minutes actual time. This beats the fastest time previously made by about ten hours. The distance steamed, according to the ship-log, was 2,861 miles, which gives an average speed of 18.61 miles an hour. Under favorable circumstances, the engines must have propelled the vessel at a speed of twenty miles an hour, for during one day a run of 472 miles was recorded. This would seem to indicate that the same vessel may yet make the passage in six days.

The engines that performed the remarkable mechanical feat of urging the Oregon, which has a carrying capacity of no less than 7,500 tons, at the high speed maintained for the long distance, are of the ordinary compound vertical inverted type, three cylinders being used standing in line above the main shaft. The high-pressure cylinder, which is in the middle, is 70 inches diameter, and the low-pressure cylinders are each 104 inches diameter, all having a stroke of six feet. The high-pressure cylinder receives the steam direct from the boiler, and exhausts into the casing, whence it is taken into the low-pressure cylinders. Piston valves are used on all the cylinders for distributing the steam. A built-up crucible steel crank is used, and all the cranks are counter-balanced. All minor parts of the engines, like the major parts, are fitted with every modern improvement calculated to secure efficiency.

Steam is generated by nine double-ended boilers, with Fox's corrugated furnaces. There are 72 furnaces, all told.

During the trip the engines are reported to have indicated as high as 13,000 horse-power. As near as we could learn, the power was maintained with a coal consumption that reached the neighborhood of 2.5 lbs. per indicated horse-power per hour. The daily expenditure of coal was 306 long tons, which would indicate that the average horse-power was about 12,000.

The crew that kept the engines going consisted of ten engineers and one hundred and ten firemen and coal trimmers. The chief engineer keeps no watch, but has continual supervision of all the machinery on board. The second, third and fourth engineers take charge of the engines in turns of four hours on and eight hours off. The fifth, sixth and seventh engineers attend to the stoke-holes and boilers in turns, their watches also lasting four hours. For attending to the bilge pumps and similar work the eighth and ninth engineers take alternate watches of six hours, and the tenth engineer attends to the deck machinery. The greasers, firemen and coal trimmers work in watches of four hours on and eight hours off duty. There are no idlers among this crew, the demand for the enormous power requiring hard work and close attention to the machinery.

This performance of the Oregon is likely to put other lines on their mettle to do likewise. Several new steamers are building from which high speed is expected, and crossing the ocean in six days may soon be a common feat. This will be done by enormous expenditure of coal, which will not bring proper returns except in the case of high-paid passenger business. This will probably in a few years make passenger and freight steamers as separate and distinct on the Atlantic as the two kinds of trains now are on railroads.

Calvert's, Mechanics Almanac for 1884 contains the usual amount of technical and industrial information. It is a pamphlet of about 70 pages, and sells for 15 cts., post paid. The agent in this country is J. A. Gardner, 132 Broome street, New York.

We have received a neatly bound volume (vol. 2, 1883-4) of the *United States Sewing Machine Times*, published weekly, from 22 Union Square, New York. It is a live paper for the sewing machine trade.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(187) R. B., Lawrence, Kan., asks: Please explain how to properly set a link-motion valve? *A.*—You will find this illustrated and explained in the AMERICAN MACHINIST of September 2, 1882.

(188) A. H., Pensacola, Fla., asks: Please give me the proportions of pyroligneous acid and alcohol to be used for etching on steel? *A.*—Pyroligneous acid 4 parts, by measure, alcohol 1 part. To this mixture add 1 part aquafortis, of 1.28 specific gravity.

(189) J. E. M., Taunton, Mass., asks: 1. If I were to turn a taper tap 5/8" taper to the foot, how much should I set the tailstock over? *A.*—5-16" for every foot in length of tap. 2. Is there any work on turning tapers? *A.*—Not that we are aware of.

(190) A. F. C., Fitzwilliam Depot, N. H., asks: In which way will the most coal (bituminous) be saved; by banking the fire under the boiler, or by letting it go out and building a new fire in the morning. *A.*—There will not be very much difference. All things considered, if the coal is of good quality, it is better to bank the fire.

(191) A. G. D., Ansonia, Conn., asks: What size boiler and engine will I require for a boat 20 feet long, 7 feet beam, to make eight to ten knots an hour? *A.*—We should say engine 3"x5", boiler 28" diameter, and 46" high, would be about right. We hardly think you will get the speed named.

(192) W. S., Springfield, Ill., asks: 1. How long before the porous cut of a Leclanche battery will be exhausted, the battery being used about five minutes each day? *A.*—It will be impossible to tell. Dealers in such batteries can give you an approximate estimate. 2. Why are gas engines single acting? *A.*—It would require greater complication to make them double acting, and a great consideration in such engines is that they be simple.

(193) A. B. B., Brantford, Ont., writes: Which of the two, a Cornish boiler or a tubular boiler, will evaporate the most water per pound of coal, both boilers to be, say 5 feet diameter and 15 feet long, the Cornish boiler to have two flues, the fire in the flues, the products of combustion to pass under the boiler and along the sides to the chimney, and the tubular boiler to have 73 tubes 3" diameter? *A.*—We think the tubular boiler would show the best economy of fuel.

(194) Inquirer, Springfield, Mass., asks: 1. Has Bessemer steel a grain like wrought iron, and can it be cut or sheared like wrought iron? *A.*—There is great difference in the quality of Bessemer steel. Some of it resembles wrought iron and some cannot be easily distinguished from cast steel. It can be cut like iron. 2. Can it be hardened like cast steel, or case hardened like iron? *A.*—Some qualities can be hardened like cast steel, others case hardened like iron.

(195) W. O. F., ——, asks: 1. What are the sizes of wire of which machine screws are made—I find they vary from 1-1000 to 7-1000 inch? *A.*—There are several kinds of wire gauges. We can only suggest that you use the screw-wire gauge, which is not numbered like other gauges. 2. What is the size at the root of the Whitworth screw thread? *A.*—The angle of the Whitworth thread is 55°, with 1-16 of depth rounded off at top and bottom. From this you can determine size at bottom of thread.

(196) J. B. K., Albany, N. Y., writes: I had a triangle made of ¾ round steel, the sides, being 18″ long. It proved a success so far as sound was concerned, but after using about two months it commenced to crack at the bends, and finally cracked entirely through, the break being as clean as if cut with a saw. Upon examining the fractures it appeared to me as if the blacksmith had spaced the steel off and marked it with a prick punch, and that the skin being broken the vibration caused it to break entirely through. Can you give me a remedy for this breaking, if there is any other cause for it than the one I have named? *A.*—You have undoubtedly stated the reason for the break. If you will have another one made, cautioning the smith against having any marks on the steel, and especially at the corners, we think you will have no trouble with its breaking.

(197) D. G., Ishpeming, Mich., asks: In measuring the clearance of a steam engine cylinder where a cut-off valve is used on the back of main valve, should the ports through the main valve be measured; and, if so, or if not so, why? *A.*—The steam that is in these ports when the cut-off valve closes is expanded, along with that in the cylinder, until the main valve closes the port to the cylinder. Hence it forms part of the volume of steam up to that time, so that in comparing the actual and theoretical curves, up to the time the main valve closes the port, the clearance up to the face of the cut-off valve should be used. For calculating the theoretical water consumption, or for calculations relating to the compression curve, the clearance up to the main valve face should be used, as the steam in the ports through the main valve is not exhausted, nor is steam compressed into that space.

(198) Subscriber, Allegheny City, Pa., writes: I send you a sketch of a valve and seat of a steam engine. The engine seems to use too much steam. The cylinder is 8¾″x21″, running at 64 revolutions, boiler pressure 60 lbs. I would like to ask: 1. Is the valve properly proportioned; and if not, why? *A.*—The sketch shows the steam ports in cylinder to be 31-32″x3 15-16″, bridges to be 1⅜″, exhaust port 1½″, total length of valve 7⅛″, travel of valve 3¼″, exhaust lap 3-32″. The valve and seat are not well proportioned. It requires too much of the power of the engine to operate the valve. For the speed named we should suggest steam ports 9-16″x7″, bridges ½″, exhaust port 1¼″, steam lap ½″, exhaust lap 1-16″, travel of valve 2⅛″. 2. What part of the stroke does the engine cut-off at? *A.*—The cut-off will be, average of both ends, at 19″ 3. With boiler pressure of 60 lbs., assuming the steam chest pressure to be 55 lbs., what is the horse-power? *A.*—You should be able to get fifteen indicated horse-power. 4. What should be the size of exhaust pipe? *A.*—3″.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Metal & Wood Patterns–G. D. Lambert, N. Haven, Ct.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

For first-class machine patterns and estimates, address John Valentine, 15 Alling st., Newark, N. J.

INVENTIONS perfected, designed, or patented. E. P. Robbins, M. E., Cincinnati, O.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Fine tools and special machinery. Horace Thurston, 84 Clifford street, Providence, R. I.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 626 E st., Washington, D. C.

National and box chucks, foot and power lathes, and slide rests. Lodge, Barker & Co., Cincinnati, O.

Wanted—Specialties in cast iron to manufacture, heavy or light. J. B., Box 306, New Haven, Conn.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

For Sale Low—A valuable hydraulic motor patent Big improvement. Address W. Henry Philbrick, Box 343 Laconia, N. H.

Coarse or difficult screws, worms, cutters, taps, rotary files to order. Machinery invented, made. Tower Machine Works, E. Brookfield, Mass.

New Books, relating to steam, the steam engine, mechanics, machinery, and engineering. Send for catalogue. Fred. Keppy, publisher, Bridgeport, Conn.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham St., N. Y.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

"Catechism of the Locomotive."
The most complete and easily understood treatise on the locomotive; 625 pages, 250 illustrations. $2.50. For sale by "The Railroad Gazette," 73 Broadway, New York.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

Useful Information for Steam Users—A 100-page pamphlet, compiled from the best authorities, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, N.Y.

MANUFACTURES.

Generally speaking, the machinery business is dull.

C. Brunner, Peru, Ill., will build a boiler shop and warehouse.

William Cordes has started a machine shop at 1902 Walnut street, St. Louis.

C. R. Dickinson, Montgomery, Ala., will build a new foundry for D. K. Weir.

W. N. Webb & Son, Pulaski, Tenn., will enlarge their foundry and machine shop.

The Georgia Pacific Railroad will build two large warehouses at Birmingham, Ala.

The Texas and St. Louis Railway promise to erect machine shops at Pine Bluff, Ark.

Hon. J. F. Cloutman, Farmington, N. H., is to build a new shoe factory this spring.

John Dippel will erect a new wagon factory, at Sixth and Oxford strets, Philadelphia.

Max M. Heller, of Columbus, Ga., will establish large furniture factory at Savannah, Ga.

J. H. Williams, 293 Henry street, Brooklyn, N. Y., will erect a shop, 53x94 feet, to cost $8,000.

Clifton Iron Company, Talledga, Ala., have given out a contract to erect a large blast furnace.

P. A. Collier, New Gloucester, Me., has begun the manufacture of creamery machinery and fixtures.

Richard Cromwell is to erect a three-story brick factory, at Pratt and Tremont streets, Baltimore, Md.

C. Fiegenspan, Brewer, of Trenton, N. J., has just ordered two new boilers, about sixty-horse capacity each.

Hon. A. J. Chambers, Fort Worth, Tex., is organizing a company to run a tannery; capital stock, $50,000.

The E. T. Barnum Wire and Iron Works, Detroit, Mich., will build a new factory this spring, at Windsor, Ont.

Jesse Tirrell, of Boston, is to erect a 70x90-foot five-story building, for manufacturing purposes, at 304 Federal street.

Harvey W. Peace & Co., 10th and Ainslee streets, Brooklyn, N. Y., will erect an addition to their saw factory, 27x100 feet.

A. G. Jennings, Park avenue and Hall street, Brooklyn, N. Y., will erect a four-story factory, 110x38 feet, to cost $23,000.

George S. Vanatta, of South Lyon, Mich., offers to donate a building site to any manufactory which will employ twenty men.

The Blakeslee Manufacturing Company, DuQuoin, Ill, will probably erect a new foundry and put in several lathe and drill presses.

The Nashua (N. H.) Lock Company is contemplating extensive improvements the present season, which will double its facilities.

The iron moulders' strike at Quincy, Ill., has led to a combination of labor and capital in the establishment of a co-operative foundry.

The wire mill now being erected on 118th street, New York, by R. H. Wolff & Co., will be 193x55 feet, five stories high, and will cost $100,000.

S. G. and J. M. Currier, Boston, Mass., will erect a five-story building, for manufacturing purposes, at 195 High street. It is to be 42x59 feet.

The Roanoke, Va., Machine Works will add to their business the manufacture of car wheels as well as all parts of locomotives and cars.

The Cleveland, Pittsburgh, and Toledo Railroad has begun to erect a round-house 200 feet in diameter, with stalls for seventeen locomotives, at Akron, Ohio.

G. W. Blabon, of Philadelphia, will erect three three-story factories 68x137 feet, and one 53x158 feet, on Midvale street, near Nicetown street, in that city.

An iron foundry to cost $30,000 is to be built at Beverly, N. J., for a son of Jesse W. Starr, of Camden, who formerly owned and operated Starr's Iron Works.

A three-story machine shop, 41x47 feet, is to be erected in Philadelphia, on 3d street, near Dauphin, by the Enterprise Manufacturing Company. T. H. Asbury, president.

The Worcester (Mass.) Excursion-Car Company has increased its capital stock from $50,000 to $250,000. They are building two new cars and more will soon be ordered.

The Walker Manufacturing Company, Cleveland, O., is to build an extension to its foundry, and add a 14 feet boring mill, a 60-inch pulley lathe, and a 60-inch pulley borer.

Car works are to be established at Birmingham, Ala. The Elyton Land Company of that city gives special attention to promoting new manufactories.

The new Scott Printing Press Works (W. Scott & Co.) at Plainfield, N. J., are expected to be ready for operation about the middle of August, when a large force of men will be employed.

Ex-Governor George F. Drew, and others in Jacksonville, Fla., have organized a company with $1,000,000 capital stock, to purchase the patent, and push Lowrey's Chemical Motor Power.

Wm. Baragwanath, of the steam jacket, feed-water heater and purifier, bearing his name, is building a new factory in Chicago, where his boiler attachments will be made under his own supervision.

The Eagle Iron works, Hoff & Fontaine, 1162 North Third street, Philadelphia, will rebuild their entire works this year and put in new tools. They contemplate bringing out a new automatic steam engine.

The Pettee Machine Works, Newton Upper Falls, Mass., manufacturers of looms, are making extensive improvements, adding another building, 127x40 feet and three stories in height, to the one erected last year.

A company has been formed at North Adams, Mass., to manufacture the patent level invented by Lawyer C. J. Parkhurst. They have leased a building of A. C. Houghton, on River street, and propose to begin work soon.

The Allen Portable Riveting Machine Company, of 304 Broadway, New York, have built twenty of their new style portable riveters, reaching 25 and 34 inches. Three of the larger size machines are in operation at Pittsburgh, Pa.

Skinner & Wood, Erie, Pa., have about completed arrangements to open a salesroom at 45 Dey street, New York, where they will carry a full line of their engines and boilers, to meet the necessities of their increasing Eastern and export trade.

The Hon. John H. Starin has bought property at West New Brighton, Staten Island, N. Y., for $12,000, and within a short time will remove his repair shops and workmen from Communipaw, N. J., to the former place. Mr. Starin says that he will employ there 300 or 400 men.

Colonel Evers, who recently purchased several acres of land in the Yazoo delta for Philip, Marshall & Co., proposes to establish a cotton factory at Yazoo City, Miss., if the citizens will subscribe one-third of the necessary stock. He proposes that the mill shall cost $500,000 or $600,000.

The *Chattanooga* (Tenn.) *Tradesman* says: The building for the Nut and Bolt Works is now in course of erection. The machinery has been ordered and will soon arrive. It will be the only manufactory of this character in the South, and will doubtless meet with abundant success.

Dr. M. D. Halsey is making arrangements to manufacture his fire engines at Adrian, Mich. A stock company, with $500,000 capital, has been formed—mostly Detroit parties—and a contract with the Adrian Brick and Tile Manufacturing Company, to make the engines, will probably be accepted.

James Berryman has opened an office at 7 Oliver street, Boston, for the New England States agency of the Berryman feed-water heater and economic pump, made by J. B. Davis & Co., Hartford, Conn. He has been connected with that firm for the past thirteen years, and now proposes to settle in Boston.

Russell & Co., Massillon, O., have issued their annual catalogue for 1884, of threshing machines, portable and traction engines, saw mills, and other machinery. Some additions have been made to their former catalogues in the shape of new machinery. This firm is doing a large and increasing business.

The Star Machine Company (Charles Hammelmann) has nearly finished a four-story machine shop, 110x34 feet, at 198 and 200 Terrace street, Buffalo, N. Y. He will begin the manufacture of wood-working machinery, of his own design, some time in May. The shop will be run by a forty-horse power Woodbury Booth & Pryor engine

Skinner & Wood, Erie, Pa., have issued a new catalogue of their steam engines and boilers. The engines are made from five to forty-horse power, and have been constantly improved since they began to build them in 1867. They are in use in all parts of the United States, also in Central and South America. The catalogue is neatly printed and copiously illustrated.

The Dry Placer Amalgamator is the name of a new machine, patented by E. S. Bennett, 375 and 377 Lawrence street, Denver, Col., for which great success is claimed, in the way of saving gold from gravel, in mining regions where water is scarce. It is said this process will make many placer deposits available that could not be worked hitherto, through scarcity of water.

Organized at Calera, Ala.—The Nottingham Land and Iron Company, capital $1,500,000. The officers are: President, G. F. Anderson; vice-president, A. J. Fox; secretary, William Anderson; and general manager, J. D. Hardy. These are the gentlemen previously reported as intending to build an iron furnace, car works, and agricultural machinery shops.—*Baltimore Manufacturers' Record.*

Warren Speirs has broken ground for his new factory building at Aurora, Ill. The structure will be of brick, 34x62 feet in size, with a boiler-room adjoining, 12x20 feet. A first-class equipment of tools and machinery will be put in, and general machine work will be done, and a specialty made of pattern and mould making. The building will be located on South Lake street.—*Industrial World.*

W. W. Huntington and L. G. Cook are to build an elevator and storage warehouse for coarse grains, on First street, near the mouth of Bassett's Creek, at Minneapolis, Minn.

The Pratt & Whitney Company, of Hartford, Conn., after several years' experience in making stay-bolt taps, have overcome to a large degree the difficulties inseparable from such work, namely, those of making the thread true in pitch, and the tap straight throughout its length, and are prepared to furnish them of any length, from 12″ to 54″, and of any desired diameter and pitch, and form of thread.

Dean Brothers Steam Pump Works, Indianapolis, Ind., have orders for supplying seven distilleries with the vacuum apparatus required for manufacturing spirits by the Woolner *et al.* patent process. These orders require seven large independent vacuum pumps, also twelve beer and mash pumps with composition cylinders. The new process appears to be a great advance in distilling. The yield of spirits is largely increased and the old "mash tubs" abandoned.

The Southwark Foundry and Machine Company, of Philadelphia, have just received an order from the Cambria Iron Company, Johnstown, Pa., for two Porter-Allen engines of 400 and 500-horse power. These engines, when running, will make a total of thirteen Porter-Allen engines in use by that establishment. The Southwark company are also building for the Atlantic Refining Company a compound duplex pumping engine of five million gallons capacity.

A corporation to be known as the Indurated Fibre Stock Company was organized in Portland, Me., on the 3d of April, with a capital stock of $100,000. The company will at once erect several factories, the first of which will probably be at Waterville, for the manufacture of wood pulp and articles therefrom. Franklin J. Rollins is president, Elias B. Denison treasurer, and Charles A. Brown clerk, with headquarters at Portland.—*Mining and Industrial Journal.*

William Coutie & Son, Troy, N. Y., have recently contracted to build a 50-horse power engine for the Cohoes rolling mill, a 200-horse power for the Rochester cotton mill, and a 250-horse power for Orrs & Co.'s paper mill, at Troy. These engines are all to be of their well-known compound condensing type. Business is very good with this firm, they having good prospects of further orders, and having refused to tender bids for several large engines at a long distance from the works. They have largely increased their facilities for manufacture by providing more room, and by putting in new tools adapted to their work.

The boiler in the grist mill of Daniel Bathrick, at Davison station, eight miles east of Flint, Mich., burst with terrible effect. The engine house and mill were completely wrecked, and portions of the boiler and building were thrown a distance of twenty rods. John Miller, the engineer, was buried beneath the ruins, and was rescued in a dying condition. He is about twenty-six years of age, and is married. Three other persons, who were near the building when the explosion occurred, were injured, but not dangerously. The loss occasioned by the disaster is estimated at about $3,000. The explosion was caused by low water in the boiler.—*Milling World.*

The *National Labor Tribune*, in reviewing the condition of iron manufacturing in Pittsburgh, says: "The general running of the mills is much below what it should be at this time of the year. A depression of trade is reported from nearly all sides, notwithstanding there are some works which are kept actively busy, but they are only such as are working on specialties. These are the American, the Pennsylvania, and the Soho mills. In these the puddlers are working double turn all the time, excepting at the latter there is a slight falling off or stop. So far as the finishing mills are concerned they are nearly all the time on double turn on sheet iron and fire beds (locomotive boiler lining)."

The Baldwin Locomotive Works, of Philadelphia, write us, April 23d, as follows: "About two hundred men have been suspended up to this time. The demand for locomotives is not what it has been, and our force, of course, must be adapted to the production. It is a conspicuous fact that at no time in the industries of this country could a road be built and equipped so cheaply as now. The locomotives are probably cheaper to-day than ever before since the Rocket was constructed by George Stephenson, when quality and finish are considered. These things are likely to work their own cure in time. We do not know how much more our reductions will have to be, as future orders are uncertain."

Merwin McKaig, Cumberland, Md., writes us: I am running full force, and am very busy building my improved "Mogul" horizontal stationary engines, the new Keystone roller mills, pulleys, shafting, mill machinery, gearing, and the Anderson self-lubricating mine car wheels. My patterns of Mogul engines range from 10-horse to 100-horse. This is a new engine I have recently put on the market, and I anticipate excellent results from it. The new Keystone roller mill is also just on the market, and combines many new and valuable improvements; received orders in one day for eleven of them. The Anderson self-lubricating mine wheels have been on the market a little over a year. They have been giving such good results that one of our largest coal companies has ordered over 500 of them, and claim that they save 15 per cent. of their oil.

Machinists' Supplies and Iron.

NEW YORK, April 24, 1884.

The condition of the market for machinists' supplies is unchanged since our last report was made. Although trade is quite fair prices remain depressed. A prominent dealer in Richmond, Va., who was here a few days ago, reported that he had done the largest business this spring that he had ever done, but sales were made on close margins.

The demand for boiler-makers' supplies is moderate, with prices unchanged.

Boiler Plate—Common.....2 4-10c.
Refined.....2 6-10c.
Shell.....3 1-10c.
Flange.....4 1-10c.
Extra Flange.....5¼c.
Chester Steel.....5¼c.

Iron, pig American—The principal furnace companies continue to maintain an evenness between the supply and demand. This policy keeps the market steady, although the demand is light. No new feature has appeared in the trade during the week. Most of sales have been made in small lots, prices having a slight upward tendency. No. 1 X Foundry, $20.50 to $22; No. 2 X Foundry $18.50 to $19.50; Grey Forge, $16.50 to $17 50.

Scotch—The market has ruled quiet and steady, with a moderate demand for small lots. Prices are without quotable change, but the tendency is in favor of buyers. We quote Coltness, $21.75, to arrive, and $22 to $22.50 from yard; Glengarnock, $21.50 to arrive, $22 yard; Gartsherrie, $21.50 to $22; Summerlee, $21.50 to arrive, $22 yard; Carnbro, $20 50; Eglinton, $20.50 to $21; Langloan, $21.25 to arrive; Dalmellington, $20.50 to $21.

Antimony—There continues to be a moderate demand for Regulus. The supply being large prices have slightly declined Hallett's, 10¾c.; Cookson's, 11¼c. These prices can be shaded down on actual orders.

Copper—The market for ingot has ruled dull, and no business moving. Lake 14¾c. to 14¾c.; Baltimore and Western brands, 13½ to 14¼c.

Lead—There has been a sharp decline in prices, and large sales of pig. About 5,000 tons have changed hands. Prices have gone as low as 4¾c.

Tin—The market is irregular and prices unsettled. Banca, 20¾c.; Straits and Malacca, 18¾c.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

A good draughtsman wants situation. Reference given. Address T. C., AM. MACHINIST.

Theoretical and practical draughtsman now open for engagement. Address A. T., AM. MACHINIST.

First-class mech. draughtsman desires situation. Address A, 125 Clark street, Room 40, Chicago, Ill.

Wanted—By a foreman boiler maker, situation. Accustomed to all kinds of work. Address J. F., AM. MACHINIST.

Norman W. Wheeler is free to engage for iron ship building and engineering, in July. Present address, Bath, Me.

A pattern maker, of long experience, wants a position. A Western city preferred. Address P. M., Box 1, AM. MACHINIST.

Mechanical engineer, particularly experienced in mill work and steam engineering, will shortly be open for engagement. Address S. B., Box 7, AM. MACHINIST.

Wanted—Superintendent or general manager, competent to take charge of a large steel plant, making open hearth and crucible steel castings. Address "Steel," AM. MACHINIST.

Wanted—To correspond with a good practical machinist, with view of starting repair shop, or would take an interest in established business. Address "Machinist," care AM. MACHINIST.

Experienced man wants situation as foreman moulder. Printing press work a specialty; general jobbing; good references. Address D. E. Box 2, AM. MACHINIST.

Wanted—Situation in a non-Union Gray iron foundry. Have had long experience in making metal, oil, and plaster matches. Am thoroughly acquainted with all classes of bench and light floor work. Best of reference furnished. For further particulars address L. W. Boutelle, P. O. box 691, Orange, Mass.

Foundry to Lease—In complete working order, 85x45, with yard. Inquire of William Finney, 188 High street, Brooklyn, N. Y.

For sale, at a bargain—Half or entire interest in foundry and machine shop, in a good town, in western part of State, doing good business. Address E. H. Hastings, 5 Bowling Green, New York.

Wanted—Second-hand trip hammer, suitable for drawing inch stock; also, small, second-hand, straight milling machine. Must be cheap. Address L. B. Russell, treasurer, 96½ Summer street, Boston.

FOR SALE—Harris-Corliss horizontal condensing double engine, cylinders 20x42 and 18x42. Wheel 16 feet diameter and 39 inch face. In good order; replaced by larger engine.

To be seen at Planet Mills, 372 President street, Brooklyn, N. Y.

BINDERS FOR THE AMERICAN MACHINIST, $1.00 BY MAIL.
96 FULTON STREET, N. Y.

NOTES IN MECHANICAL ENGINEERING.
Compiled principally for Students, but also of great value to all Mechanical Engineers. By HENRY ADAMS. 93 pages, 12mo, $1. Descriptive Catalogue (100 pages) free
F. & F. N. SPON, 35 Murray St., N. Y.

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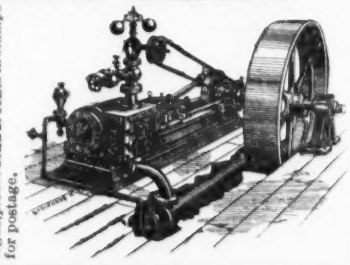
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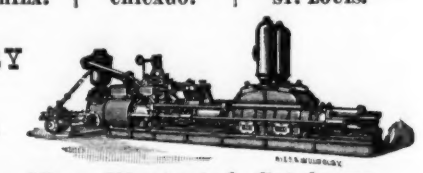
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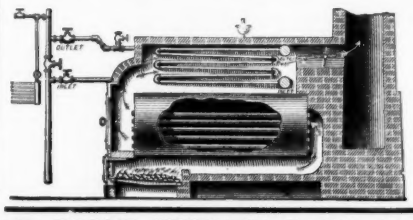
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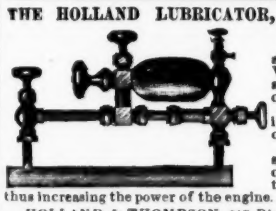
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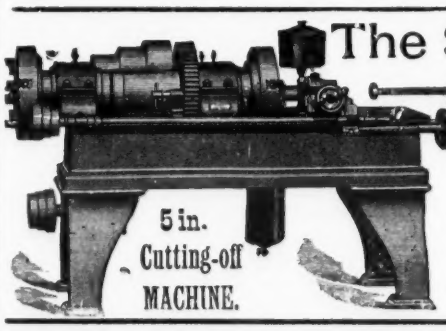

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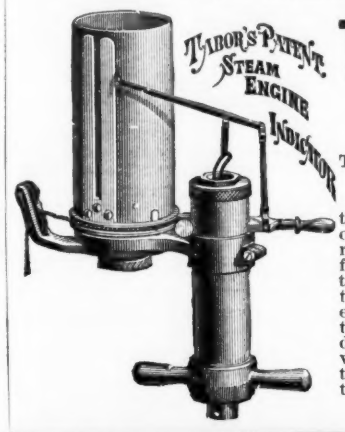

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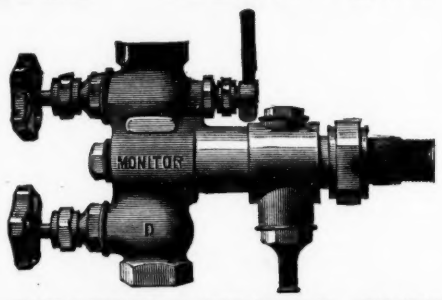

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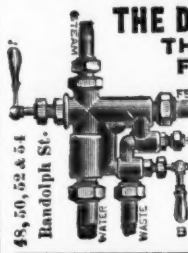

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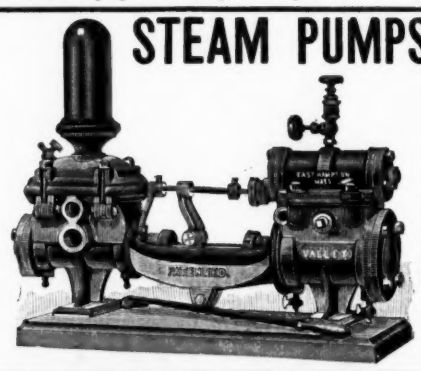
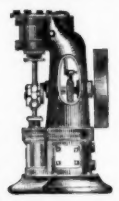
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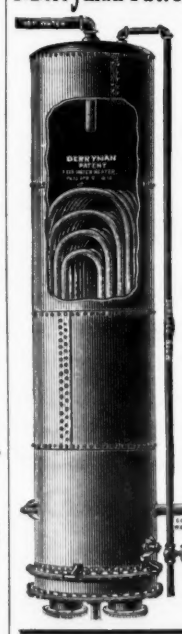

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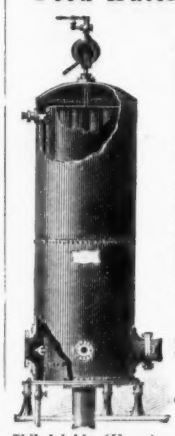
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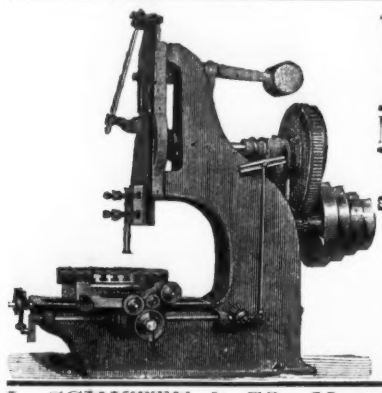

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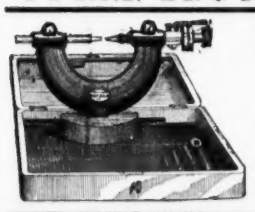

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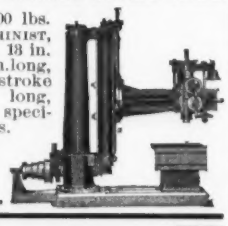

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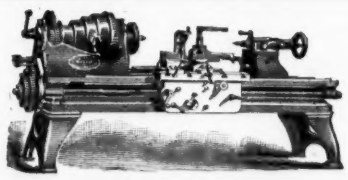

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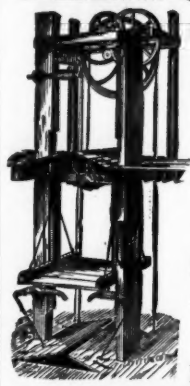

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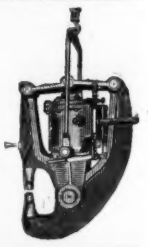

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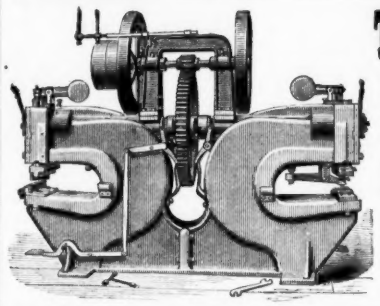

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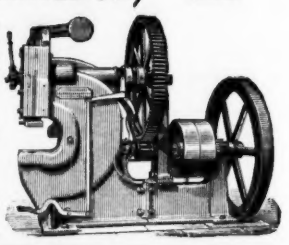

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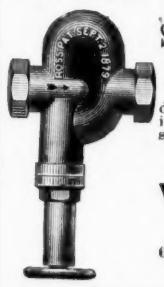

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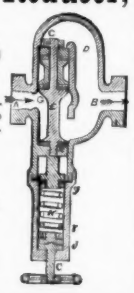

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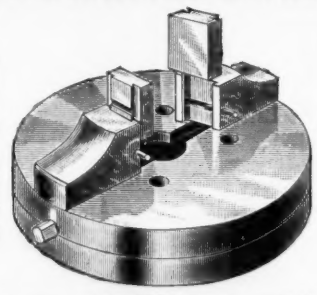

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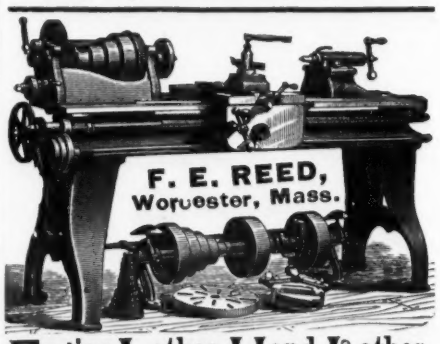

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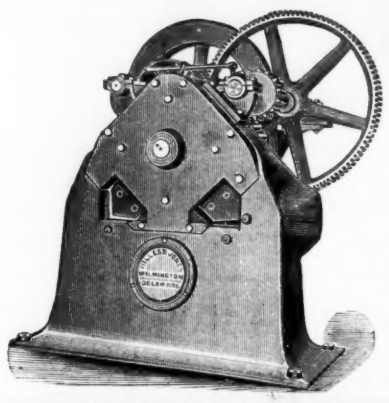

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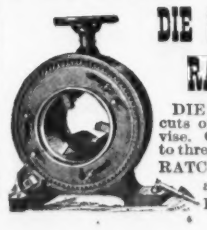

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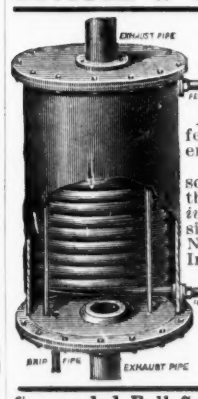

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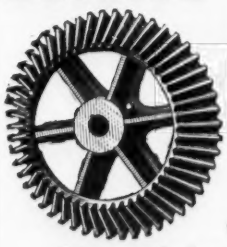

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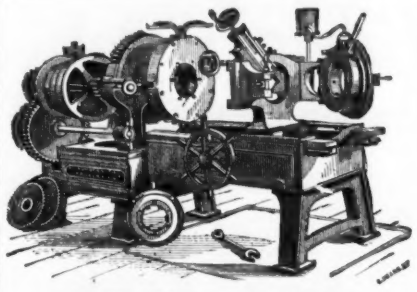

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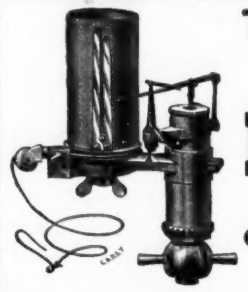

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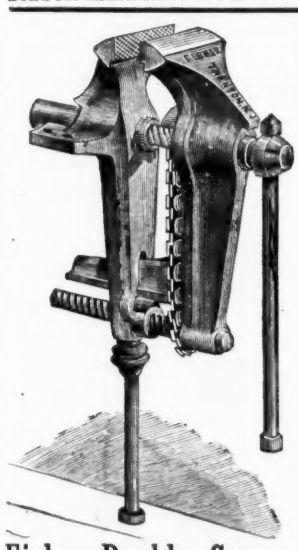

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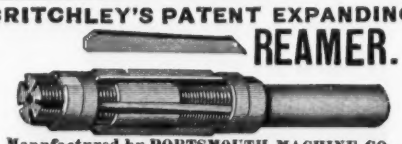

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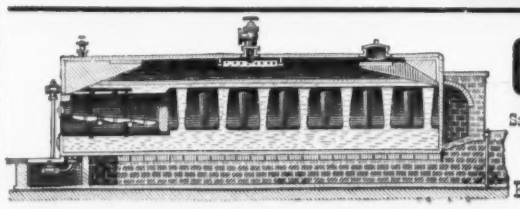

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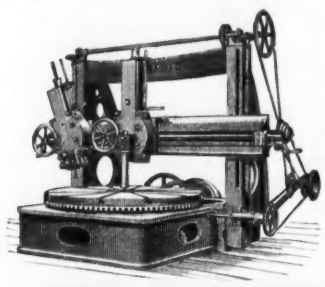

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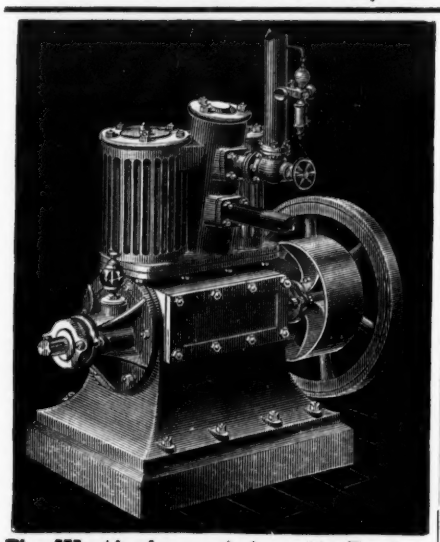

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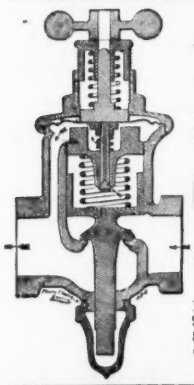

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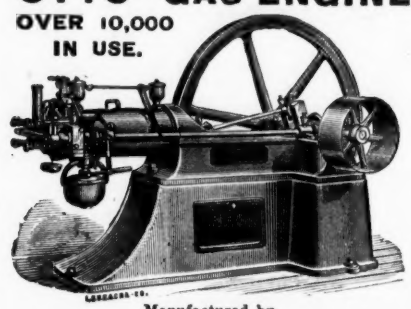

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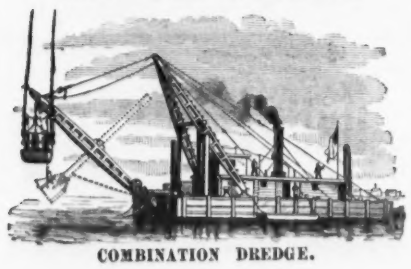

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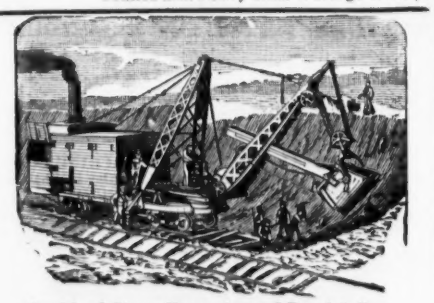

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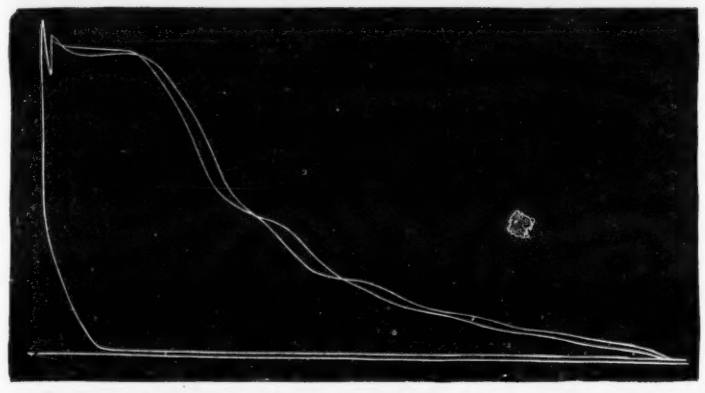

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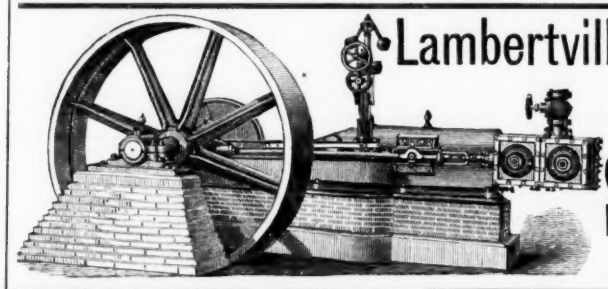

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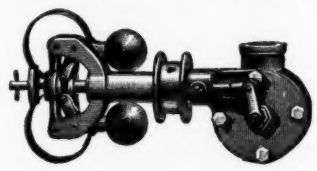

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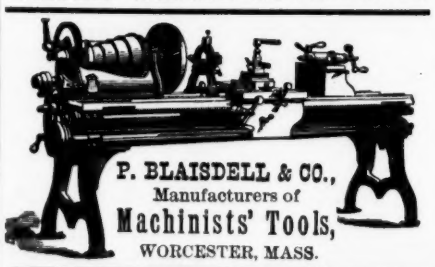

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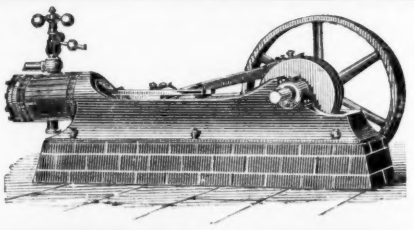

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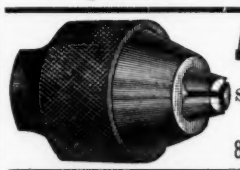

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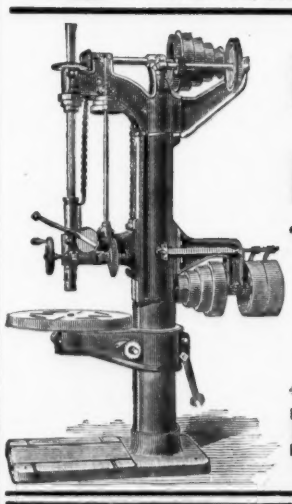

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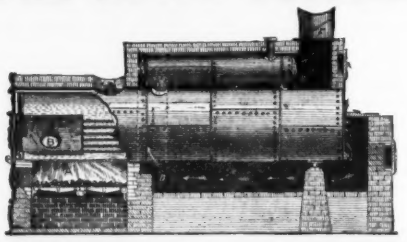

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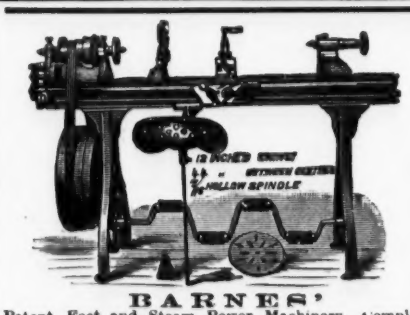

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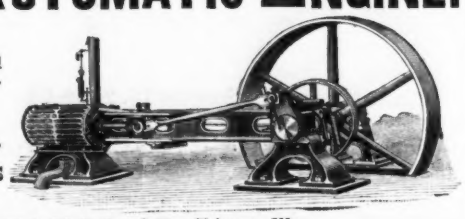

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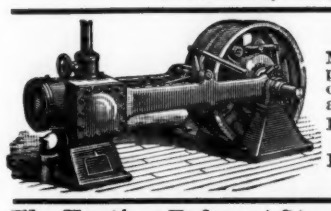

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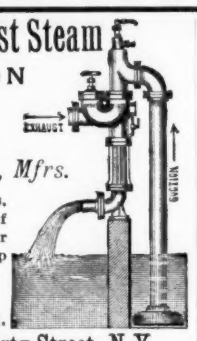

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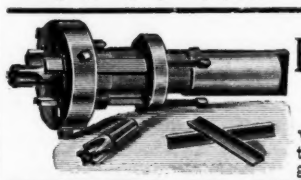

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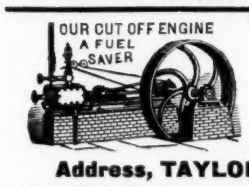

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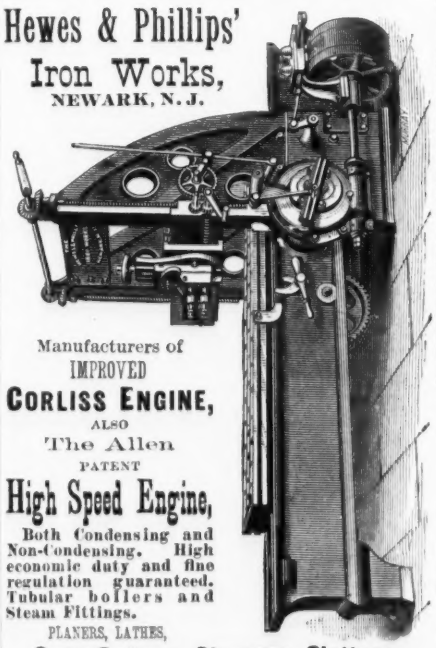

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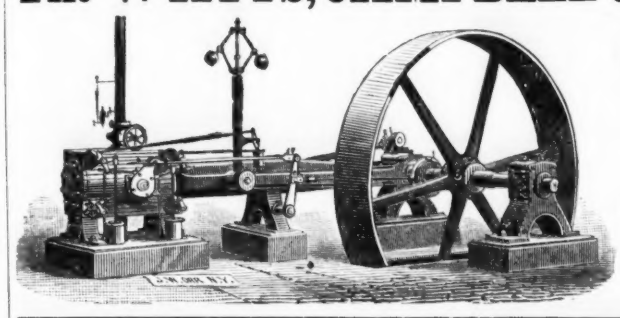

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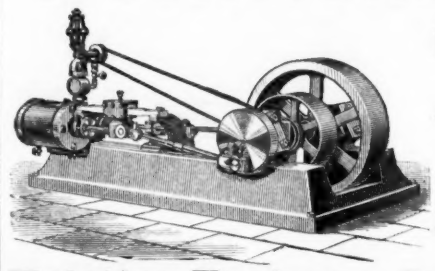

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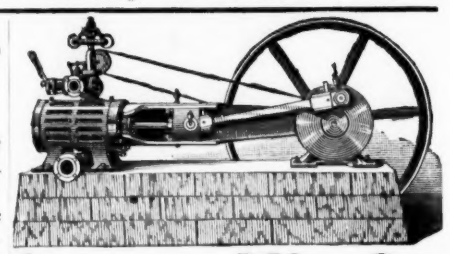

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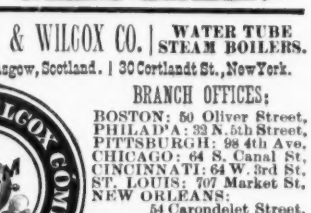

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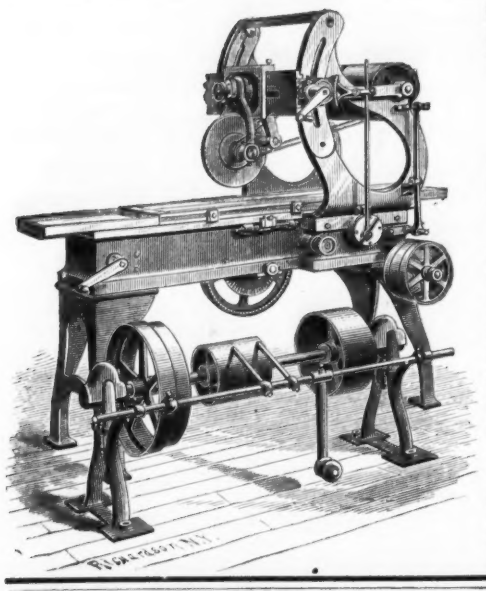

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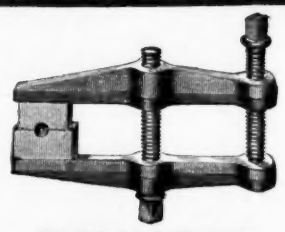

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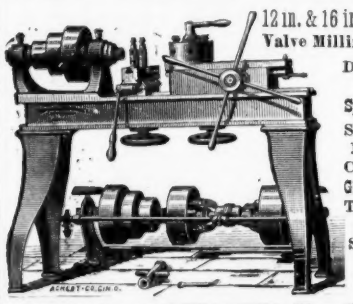

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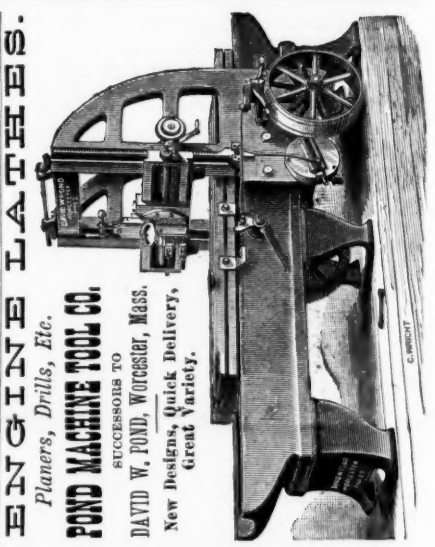

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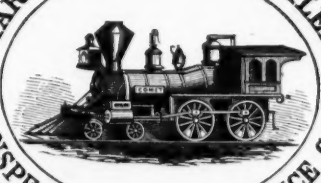

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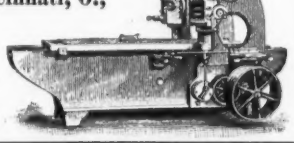

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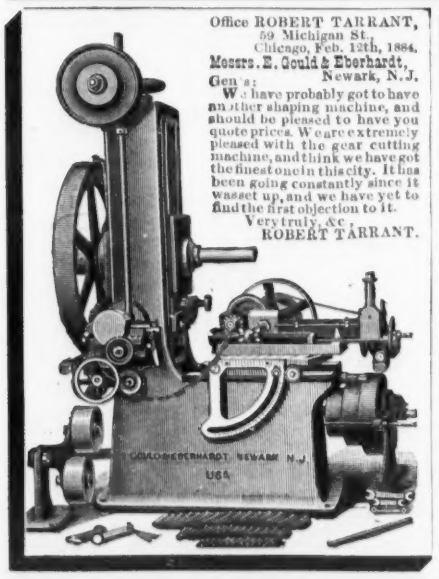

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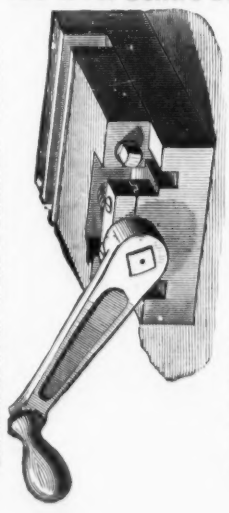

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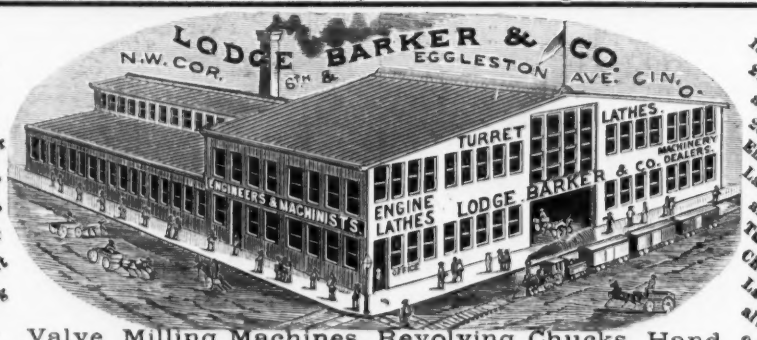

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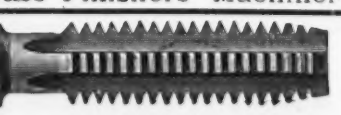

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